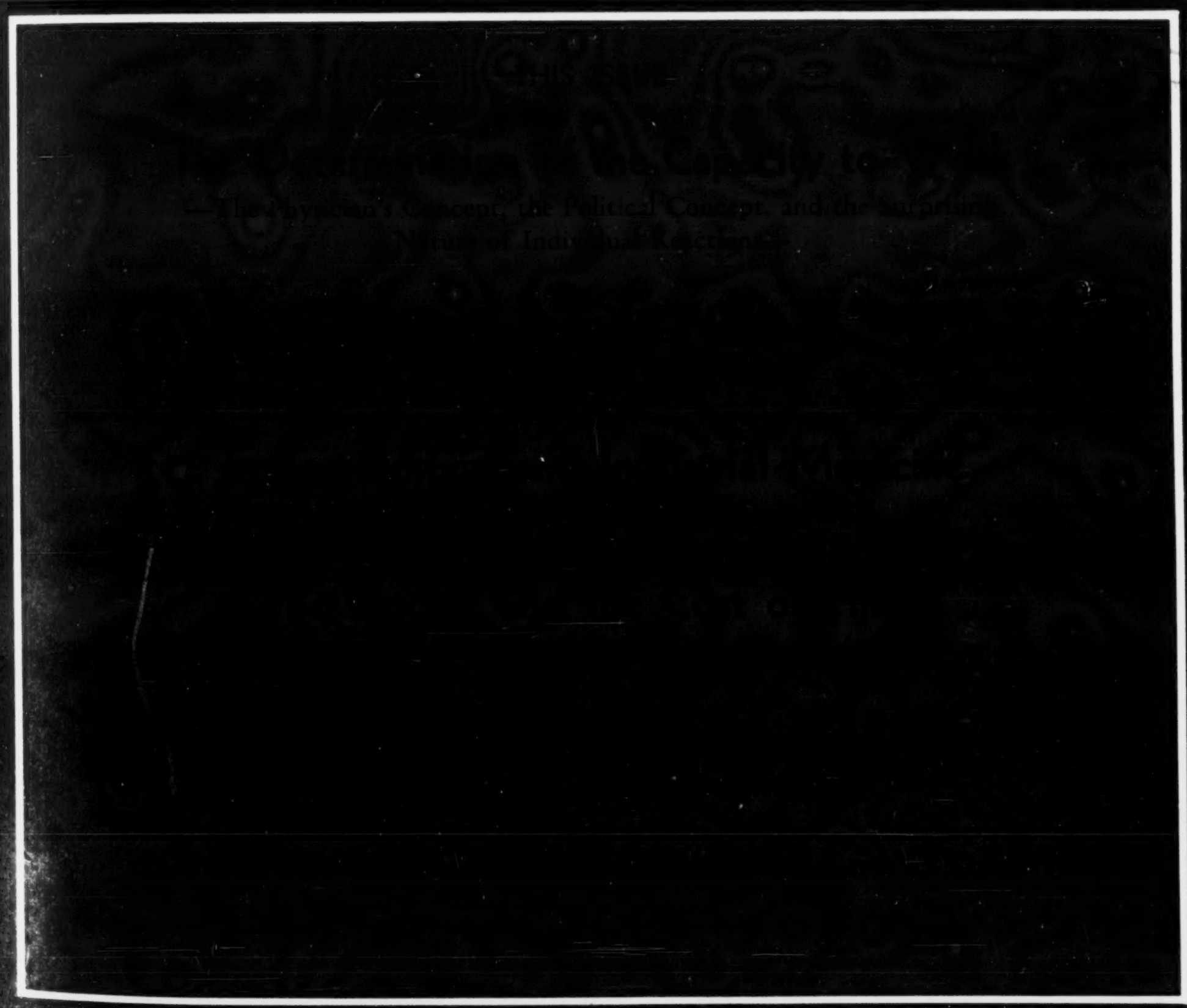
Industrial Medicine

for

Physicians and Surgeons in Industry



Sixty-fourth Annual Meeting

American Public Health Association

MILWAUKEE, WISCONSIN

October 7-10, 1935

INDUSTRIAL HYGIENE SECTION

The Program

Will include papers and reports on:

"Respiratory Disease due to Dust among Anthracite Miners",

"Practical Aspects of Occupational Diseases and their Prevention,"

"Industrial Medical Service in the Telephone Industry",

"Industrial Hygiene Instruction",

"A Program for a National Institute of Occupational Diseases".

Scientific committee reports will include Skin Irritants, Pneumonoconiosis, Ventilation and Atmospheric Pollution, Lead Poisoning, and Standard Practices in the Problem of Compensation of Occupational Diseases.

Benzol Poisoning, Lead Poisoning, Pulmonary Asbestosis and Dust Determinations will also be discussed.

The Speakers

The following well-known names appear on the program:

Dr. J. A. Britton, Supervisor of Medical Service, International Harvester Company,

Mr. J. J. Bloomfield, of the United States Public Health Service,

Dr. C. O. Sappington, Consulting Industrial Hygienist,

Dr. Edward S. McSweeny, Medical Director of the New York Telephone Company,

Dr. Emory W. Sink, Assistant Professor of Hygiene and Public Health at the University of Michigan, and

Dr. Henry H. Kessler, Medical Director of the New Jersey Rehabilitation Commission.

The Audience

Industrial physicians, directors of industrial relations, industrial nurses, industrial hygienists and others concerned with medicine and hygiene in industry.

An Invitation

The readers of this magazine are cordially invited to attend the Milwaukee sessions, the week of October 7, and participate in the discussions.

The Chairman and Secretary of the Industrial Hygiene Section will welcome your inquiries.

HENRY H. KESSLER, M.D., Chairman
Medical Director, N. J. Rehabilitation Commission.

BERNARD S. COLEMAN, Executive Secy.
N. Y. Tuberculosis & Health Assn.,
386 Fourth Avenue, New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION

50 West 50th Street, New York, N. Y.

"Of obedience, faith, adhesiveness;
As I stand aloof and look, there is
to me something profoundly af-
fecting in large masses of men,
following the lead of those who
do not believe in men."

Industrial Medicine

Reg. U. S. Pat. Off.

"Silent and amazed, even when a
little boy,
I remember I heard the preacher
every Sunday put God in his
statements,
As contending against some being
or influence."
—WALT WHITMAN.

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The Law, the Science and the Economics of Industrial Health

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Determination of Capacity to Work

—*The Physician's Concept, the Political Concept, and the Surprising Nature of Individual Reactions*—

by

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THE capacity to work is a concept that has many meanings, depending on the bias or interest of the particular investigator. Whatever the interpretation, its place in the economic and social life of the nation has assumed an unusual importance.

In the field of industrial management, a careful selection of workers according to their work capacity and their proper allocation in industry is necessary for productive efficiency.

The evaluation of the capacity to work is also of importance in accident prevention. A thin man working at lifting heavy loads may be subject to unusual back strains. A man with a large vital capacity may be more subject to lead poisoning because of his greater intake of dust at each inspiration. An individual with a slow reaction time may be prone to accidents in types of work where alertness is necessary.

The determination of the capacity to work is of especial significance in the field of social insurance. Of the 13 million persons who receive pensions, relief money and sickness benefits from public sources in Germany today at least six million must pass through the hands of a physician for the purpose of verifying the right of the petitioner to his claim. The German physician, therefore, holds in his hand a sieve through which every tenth citizen must pass in order to determine the particular economic category upon which his destiny depends. This novel fact reveals the social importance that the physician is assuming aside from his purely professional and technical role. Entrance into illness and emergence from illness are coupled with entrance into and emergence from disablement for work. This means that since more than two-thirds of the population are insured, the physician, through his role in determining the capacity to work, has a definite control over the national income. As well known as these facts are, so little are they appreciated in the course of ordinary medical practice or by the sick or disabled person.

But what has political economy and social science to do with pathology? The answer is two-fold:

First, custom and legislation have given the physician a new social power, but medicine has not provided the physician with the means to use this power. Is there any system of pathology through which the capacity to work can be clearly determined? No. Pathology determines the nature of an illness but not the extent of the remaining health or the extent of adaptation of the remaining functions. A person lives not only with his pathological lesion but also with the remaining undisturbed organs and functions. Subtracting a patient's symptoms and signs from 100% is abstract medico-social mathematics.

Second, society has forced the physician to derive a social judgment out of pathology. A man lame in two legs may be fully capable of work while a neurotic may be completely incapacitated. This is an inconsistency and conflict that we frequently find between the pathology of defect and the economy of working capacity. While lead poisoning, spondylitis are medical illnesses, incapacity to work is a social illness.

Despite the fact that workmen's compensation represents the only form of social insurance in this country, closer examination will reveal that it represents all forms of social insurance. Workmen's compensation may be interpreted as sickness insurance, since an individual suffering from a pre-existing disease, such as tuberculosis, or arthritis, will receive compensation for the disability arising out of this illness alleged to be due to, or aggravated by, injury. Workmen's compensation is, of course, accidental insurance. Workmen's compensation may be regarded as unemployment insurance, since many individuals after full recovery do not return to work because of an alleged incapacity to work. They are being paid for being unemployed, and not for being injured. Workmen's compensation can also be con-

* Presented at the Twentieth Annual Meeting of the American Association of Industrial Physicians and Surgeons, Philadelphia, June 10, 1935.

sidered as old age insurance, since the worker past middle life who sustains minor injuries professes protracted and permanent disability for conditions arising out of physical deterioration and not the primary result of the injury.

In social insurance the physician must assume a function that is frequently beyond his powers. This function is usually a judicial one. He is asked to evaluate the effects of the injury sustained by the worker on his earning and working capacity. These prognostications form the partial basis for the computation of damages in public accidents, while in industrial accidents they form the major basis for the determination of the compensation paid. It is at this point that many inconsistencies arise between the concept of capacity to work as visualized by the physician, and the political concept defined by the law.

For pension purposes, a great variety of definitions exist in the laws of different countries. For example, ability to earn under the German Invalidity laws is considered in its widest sense "as the power for continuous work serving a morally useful purpose. This power is based on the sum of the qualifications of the person with reference to the usefulness of the members, and the other organs of the body, especially the central nervous system and the sense organs, and includes not only all the powers of the body and mind, but the knowledge and abilities that have been acquired through training and experience." Inability to earn in its widest sense is considered as the inability of the individual to use his own work capacity to make a living, or to follow a profession. Inability to work in the sense of sickness insurance exists when the insured person is prevented by illness from performing his previous occupation without endangering his health through an aggravation of an existing illness, which in itself might not prevent the person's inability to work. Inability to work may also be said to exist when, after a discharge from the hospital, the worker is advised by a physician to avoid a recurrence of his illness by his work. Inability to work does not exist when as a result of his previous illness, conditions in the labor market make it impossible for him to obtain work, even though he has sufficient physical capacity to perform it.

The German Invalidity Laws award invalidity pension for those who have lost two-thirds of their normal capacity to work. The law contains a very ambiguous interpretation of the method of determining this two-thirds of work capacity.

Not only in social insurance, but also in life insurance and private accident and health insurance and in the protective social schemes found in lodges, fraternities and mutual aid societies, in E. R. A. and Mothers' Pension Laws, the determination of working capacity is important. Sick benefits in these various organizations are allotted on the basis of medical reports as to the degree of incapacity to work.

HOW are these determinations made? Generally in two ways: by intuitive correlation, and by scientific methods. By intuitive correlation I mean the use of an intuitive faculty which gives us direct knowledge. That knowledge may be obtained not only by scientific methods but also intuitively is best understood by reference to the fact that the reality of religion, music, esthetics, right and wrong, even humor, is made known to us without the intervention of the methods of science. Science abstracts and selects a small section of the universe but gives us no answer to the whole of it. The evaluation of incapacity to work is frequently made on our judgment referring by that term our whole experience in judging the fitness of men to work.

The capacity for work is regarded as a mechanical concept and the human body is considered a machine capable of expending energy for the execution of certain work. Thus regarded, the useful mechanical work, the industrial effect, is a quantity which can generally be calculated without difficulty. The work done in ascending a mountain, a staircase, or a ladder is the product of the weight of the body and the vertical height ascended. The work of a cyclist is the product of the distance covered and the passive resistances of rolling, friction, etc. The amount done by the arms and legs in operating tools, or work done in locomotion, is also measureable more or less exactly. This mechanical quantity is more difficult to measure especially when the movements are diverse and complicated, because any static effort of the workman escapes the measurements although the whole muscular activity consists of static efforts.

As a machine the body is regarded as subject to loss of thermodynamics applicable to all machines. Every machine transforms energy, for example, the thermo-energy of the coal in the boiler is transformed in the steam turbine or reciprocating engines. This may again be transformed into electrical energy in the dynamo. In any motor the total expenditure of energy may be divided into the static expenditure needed to overcome the forces of friction and the dynamic expenditure which corresponds to the useful work done. In inanimate machines the static expenditure is small compared with the dynamic expenditure, but this is not the case in the animal motor which is always at pressure, because if it ceased an instant to be in that state life itself would be arrested. The static expenditure in the human motor constantly takes place and is permanent because it is determined by physiological necessities, and this difference between inanimate and animal machines is a factor which has been seriously overlooked by those who have attempted to interpret the human body as a machine, and who have established certain indices of its function.

General tests of bodily function or efficiency have been used by many. Usually these are based on so-called tests of cardiovascular efficiency. The pulse rate and blood pressure are taken before and after exercises and compared to arbitrary normals. It is assumed from these tests that these findings represent the efficiency of the body in its adaptation to work. In addition to these general functional tests, specific functional tests have been developed for the extremities and for vital organs. For example, the motion of the joint of an extremity, the strength of the muscle that acts to make it move, and the coordination of these muscles may be combined and used an as index of the functional efficiency of that member. Again turning specifically to the lung, the vital capacity CO_2 combining power and the pulmonary ventilation expressed by physico-mechanical indices have

been used as an index of the total body function.

All these tests, however, are false first, because they do not evaluate the total body, but select and abstract only a small part of it; and, second, because of the mechanical fallacy.

Physicians, as well as laymen, frequently commit the error of undervaluating the individual's capacity to work. It is often assumed that a physical defect causes limitation of functional activity and hence limitation of industrial usefulness.

This line of reasoning is frequently invalid. While it must be conceded that the disability may limit the number of opportunities open to the disabled person, it is far from correct to assume that a physical disability always means incapacity to work. Regardless of the yardstick used, the judgment is apt to be false. This error is due to the ever present psychic component and, secondly, the presence of the safety factor.

AN IMPORTANT aspect of the psychic component is our concept of the term illness. Although it may be only of philosophical interest, there are, nevertheless, practical implications in the interpretation of the term illness which influence the judgment of the physician making the determination of work capacity.

What is illness and who is ill?

There are many points of view with respect to this definition. There is a medical concept and a legal concept of illness, and a special concept coming under the influence of the insurance laws. In the latter sense, the worker does not necessarily need to be medically ill in order to require treatment. Yet he may be ill from the standpoint of insurance laws. Let me give some examples.

Am I ill if the cells in my stomach begin to proliferate and develop cancer, or the tubercle bacilli start their destructive work in my lungs without my being conscious of it? Certainly.

If, when an individual is to hold his first public lecture and the day before is excited, cannot sleep, trembles, loses his appetite, has heart palpitation, loses weight, his reflex actions become abnormal and he feels uncomfortable or ill, or being sued and brought to court with the possibility of being sentenced or fined, is such an individual ill? No, this is only mental reaction.

If I try an hypnotic experiment on you so that you bite a piece of soap and think it is an apple, are you ill? No. This is an exceptional mental condition which lies in the field of the normal and is a phenomenon of suggestion.

When an individual feels all sorts of uncomfortable symptoms in his body, is afraid that he has hardening of the arteries, cancer or consumption, and when on that account he goes to a physician, is this hypochondriacal fear illness? No. This, too, is a mental reaction.

FROM these examples we find two aspects of illness:

1. The state of *being* ill.
2. The state of *feeling* ill.

Strictly speaking, our efforts to obtain an exact concept of illness are futile. But as physicians we are daily concerned with the concepts of illness and ill. It appears necessary, therefore to define the concept medically so that it becomes as exact as possible and not ambiguous.

If we consider the body as a unified structure composed of mind and body expressing life, then illness, the state of being ill, is any value introduced within the structure which will tend to break it down. Such values are injurious and hostile to life, to the normal life processes in the body, and work destructively, leading in severe cases to death. Illnesses are dynamic, as opposed to abnormalities which are static.

On the other hand, feeling ill is a subjective feeling of bodily changes in our important vital life processes. These latter conditions can develop as a result of our emotional life without any destructive process of illness going on. Vital processes like the circulation, respiration and metabolism may be altered through an illness but also psychically. In both cases conditions develop which subjectively are similar. To be a patient means to suffer, but does not necessarily mean that one is ill.

Naturally the patient himself is apt to consider his subjective condition of suffering as a sign of objective illness. The patient doesn't know the difference between true vegetative feelings of illness and the condition of suffering that has been produced psychically, especially since the latter may even be added to the former. Many a physician when he is a patient does not generally differentiate between the two.

These considerations are parts of the intuitive judgment which are included in the determination of the incapacity or capacity to work.

The second element of error is due to the safety factor.

A case in point is that of a 40-year-old painter, who, following a fall from a scaffold, suffered a fractured spine and spinal cord injury with subsequent spastic paralysis of both lower extremities. After a prolonged period of hospitalization and after-treatment, his disability was still so severe that he was certified as totally disabled. Ten years later he appeared at the office of the New Jersey Rehabilitation Commission, seeking employment. He was able to get about with a rather awkward spastic gait, but without the aid of a crutch or apparatus. Surprised by his application, we were amazed to learn that he had been working for a period of 10 years as a structural iron worker in construction of the tallest skyscrapers in New York. His employer, for whom he had worked regularly for 10 years, had gone out of business, and, although he had received excellent credentials, no one would hire him because he was a cripple.

In another case, a 43-year old white adult, male, presented himself with a fusion of both hips with the legs crossed so that in order to walk it was necessary for him to place one foot in front of the other. Despite this rather serious disability, this man has worked and has earned as much as $10,000 a year standing behind a counter from 14 to 18 hours.

In still another case, a World War veteran on total disability compensation for chronic pulmonary tuberculosis receiving his refills once every 10 days, was employed as taxi driver from 14 to 18 hours every day in Washington, D. C.

IT IS apparent that the same type of disability does not have similar consequences in all individuals. This applies not only to vocational or professional capabilities, but also to the basic use

of the affected part. It is apparent that the amputation of the tip of the right index finger would seriously handicap a watchmaker, a typist or a violinist; yet, the same injury would be insignificant to a longshoreman, a truck driver or a laborer. But aside from the specific vocational handicap, workers will respond differently to accidental injuries. The mental make-up, the social environment, the education and the economic status, all play important roles in the effect of a disability on the individual's future.

In other words, every man is a law unto himself, and no two are alike.

While one would be depressed as a result of his disability, lose his courage and suffer marked loss of earnings, another, under the same circumstances, might be stimulated by his misfortune to greater efforts and his earnings might even be increased. The case histories of 4,404 men with permanent orthopedic disabilities, covering a period of 13 years, were examined by Anderson and the actual jobs they had held for that period of time were listed. The findings indicated that among 10,176 jobs held by these men, there were 635 different types of work, representing 70% of the 557 occupations and occupational groups listed in the United States census of 1930. These figures give striking evidence of the versatility of these handicapped men.

In 1925 the United States Federal Board of Vocational Education made a study of the occupations in which 6,097 disabled persons were employed after being rehabilitated. The analysis showed that there was a remarkable diversity of jobs in which these persons were employed, with no less than 625 different occupational classifications.

It has been the writer's privilege to have examined over 75,000 cases of accidental injuries for the New Jersey Rehabilitation Commission during a period of 15 years. In this large group of injured workers, a change in vocation was necessary only in disabilities of a very major character, such as amputations or ankylosis of major joints. Even in those cases, in which as much as 75% loss of efficiency of the body for the routine pursuits of life had been estimated, the disabled person with courage and perseverance was still able to pursue his former calling.

THE determination of the economic incapacity of a person who has suffered a fractured spine, a musculospiral paralysis or an ankylosed joint or silicosis can only be made by arbitrary methods. The clinical examination provides no means of scientifically determining the work capacity, nor does it show the type of work for which a patient is fitted. What special operations in a particular job cause physical strain? When does the greatest fatigue take place? Are special constitutional types necessary for different tasks? The lack of adequate data makes it impossible to answer these questions from a physiological point of view. Recent developments in the field of psycho-technique, such as the testing of mental and physical traits, at first seemed encouraging. However, they have not measured up to expectations. There is little doubt that many decisions by physicians concerning disability must be entirely false in an objective sense. The capacity for work, which is frequently evaluated in industrial accident cases, is a concept that has no definite interpretation.

It is very difficult to determine the meaning of the term "unfit," "defective" and "abnormal." The use of the term "normal" implies a judgment in which we who consider ourselves normal use ourselves as the standard, and the subject of our attention as the possible deviation from this standard. The concept of a "normal" being is a social judgment and represents a series of physical traits consistent with social prejudicies and attitudes.

How do these physically disabled persons manage to make their physiological adjustments? How do they accommodate themselves to the unusual demands made by disease or by congenital or acquired defects? The answer will depend on the presence of human safety factors.

The human organism must maintain its normal function in the presence of disease or its dies. This is accomplished by drawing upon extra resources in its own structure. An individual can get along with one-quarter of a lung capacity, with one-third of a kidney, with one-quarter of a liver, without a stomach, without a large intestine, with one-tenth of the suprarenal, with one-half of the total volume of blood, with 20% hemoglobin. Among these safety factors one notes the excessive amount of ferments in the digestive tract, the ability to substitute one food stuff for another. The kidney, for example, can eliminate much more water than it is usually called upon to do, as in diabetes insipidus. Muscles are capable of more work than they are ordinarily called upon to perform. One structure may substitute for another, such as the skin for the kidney. It is through these factors of self-repair, regeneration, hypertrophy, and vicariousness of function that the body is able to combat its environment. This role of adaptation in the rehabilitation of the physically handicapped is an important one. It is a biological and natural process, and consists of the continuous adjustment of internal conditions.

PERSONALITY maladjustment plays an even more important role in the causation of incapacity to work than the physical deformity which may be so great as to completely suppress the individual.

Conversely, the organic defect may act as a stimulus to overcompensation, so as practically to eliminate the physical defect from consideration. According to Alfred Adler, the majority of us are equipped with potentialities which have not been developed to their fullest extent. Yet with this incomplete development good performances are turned out, just as our ancestors produced great work with imperfect tools. It is possible for a man with defective organs actually to develop an ingenious technique to overcome the rigors of his environment. He may pay a great deal of attention to detail, devise more unerring shortcuts and undergo a more intensive training. Great and really worth while accomplishments have been achieved by individuals through the exercise of power requisite to meet these demands. Despite all these theoretical difficulties, we are faced with a practical problem and what are we going to do about it?

Though the evaluation of work capacity is theoretically impossible, we are, nevertheless, faced with the task of providing a practical solu-

tion of the problem. The nearest approach to an accurate judgment of reduced working capacity is that encountered under conditions simulating a work environment. This can be carried out by utilizing a workshop similar to one associated with the New Jersey Rehabilitation Commission. This is equipped as a complete woodwork and paint shop, and contains all the tools used in carpentry and cabinet-making, with the exception of automatic machinery.

A disabled person is referred to the shop and is then assigned to work consistent with the nature of his handicap. Generally the worker commences with coping saw practice, sandpapering or rough painting. As he demonstrates his ability he is advanced to light carpentry, and finally to general carpentry. When he has consistently demonstrated his ability to undertake the heaviest operations for one month, he is referred for placement.

Observation of the individual in the workshop is a valid means of determining his capacity to work. The work processes are graded into three classes, light, moderate, and heavy, and an arbitrary percentage of disability is designated for each class.

Although the curative workshop serves as a laboratory for the determination of the work capacity of the individual, the period of observation in the shop frequently results in recovery. Not only are the workers with marked neurosis materially benefitted, but even those with definite focal injuries demonstrate a working capacity far beyond the estimates made by the examiners.

Manganese Poisoning Case

By WM. D. MCNALLY, A. B., M. D.,
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POISONING by manganese is very rare, the author having seen only two cases in 25 years. The first report of manganese intoxication was made by Couper in 1837; this was followed in 1901 by reports of similiar cases by Von Jaksch and Embden. The first American report of manganese poisoning was made by Casamajor in 1912.[1] The modes of absorption, the clinical history, the diagonsis and prevention of manganese poisoning have been covered in an article by Edsall, Wilbur and Drinker.[2]

Many cases of manganese poisoning probably remain undiagnosed because the occupational history was not carefully taken or was entirely overlooked. Cases of manganese poisoning are rare because all invididuals are not equally susceptible to intoxication by this agency. There seems to be a greater susceptibility or acquired individual prediposition for developing manganese poisoning. In some cases predisposing factors such as alcoholism, infectious fevers, excessive use of tobacco, head injuries, seem to aid the natural predisposition. The systoms developed by workers in manganese dust are frequently very much like those of the Parkinson syndrome. Most of the cases that have been reported show symptoms of impulsive laughter and weeping while the individual is engaged in a normal conversation. Monotonous speech, retropulsion, psychic alterations, are common symptoms. There appears to be no disturbance of the sensory organs. Patellar reflexes are exaggerated. The Babinski sign is usually negative. There is no nystagmus. Alimentary glycosuria has been reported in a few cases.

The most typical symptom reported is the gait. The individual may walk with feet wide apart, dragging his feet partially on the side, somewhat similar to the manner described as the spastic paretic type.

The majority of the cases described have a marked retropulsion, although the short, rapid, forward movements are also noted in the same individual.

The case I want to present is that of a man, 29 years of age, who worked as a laborer in the ore department of a battery company, transporting, loading and handling in various ways manganese in powdered form. The man was engaged in this type of work for 14 months, when he noticed that after dumping a wheelbarrow of dust, he stepped back and had difficutly in stopping himself. In a week's time he had become progressively worse. Because of the danger of injuring himself by falling into machinery in the plant, he stopped work and has not worked since. There was practically no change in his condition for six months. Then he noticed that if he walked too far he developed a rapid gait which ended in a fall unless someone was present to assist him. This tendency progressed for about four months and has remained practically the same since. At the present time he has great difficulty in walking alone and is afraid to trust himself. This condition is aggravated by fatigue and excitement. In the last five months he has developed a tremor of the right leg which involves the entire leg. It is a coarse tremor. He can stop it voluntarily by putting his foot on the floor and holding it there. But the tremor begins again when his attention is diverted. There has been no tremor of the hands, head or left leg. He has never developed any sensory disturbances. He claims that he sleeps well, uses tobacco moderately and does not use alcohol because he finds that it makes his legs worse.

Physical examination reveals a well nourished and developed white male who does not appear acutely ill. His pupils are wide and equal and react to light and accommodation. There is a lateral nystagmus at extreme right gaze. His blood pressure is 120/74; his pulse is 80. There are no murmurs. Babinski is negative. He is very sensitive to pain. His touch seems to be unimpaired. The patient stands steady for a little while, after which he begins to sway slightly. (Romberg positive).

GAIT: The patient stands on a wide base and is very unsteady and uncertain of himself. He needs help to walk and moves with a propulsion gait. If asked to step back he takes a few steps and falls into the examiner's arms. At times he walks on his toes. He tends to slide the right foot. The gait appears to be spastic in type.

The facial expression is somewhat fixed and the patient does not talk a great deal. Biceps and triceps reflexes in left arm slightly exaggerated. Reflex response is slight in both legs. His face is definitely expressionless; his voice a little monotonous. There is a slight tremor of the tongue.

1. *J.A.M.A.*, 1913, 60, 646.
2 *J. Indus. Hyg.*, 1919, 1, 183.

Liver function was excellent. Blood Wasserman was negative. Blood chemistry was normal except for the cholesterol content which was 196.6. The urine and stool were negative for manganese. The spinal fluid was negative for manganese; 1.25 mgms. of manganese were found in 35 gms. of blood.

Blood Examination:

Hb.	R.B.C.	W.B.C.	N	S.M.	T.E.	Stain	Counted Cells
90	5,030,000	10.000	56	39	4 1	W	100

(Red cells unchanged)

Urinalysis:

Appearance	Specific Gravity	Rea.	Sug.	Alb.	Bile.	Blood	Sediment
Straw clear	1.010	Alk.	0	0	0	0	RBC ..... 0 WBC ..... 0 Casts .... 0 Epith. cells ..... 0 Debris .. 0

Blood Constituents in Mgms. Per 100 C.C.:

Wasser-mann	Cholesterol	Urea N.	Uric Acid	Creatinine	Total N.P.N.	Co_2 Vol.%	Sugar	Chlorides as NaCl
Neg.	196.6	14.0	4.0	1.7	37.6	61.4	100.0	470

Cerebro Spinal Fluid:

Cell count	Non-ne	Ross-Jones	Wasser-mann	Lange 1,2,3,4,5,6,7,8,9,10	Sug.	Tot. Pro.
1 WBC	*	Neg	Neg.	0 0 0 1 1 1 0 0 0 0	75.4	26.4

* Slight trace.

INDUSTRIAL physicians should be on the alert in every factory employing manganese, in the making of dry batteries, the production of chlorine or oxygen, in glass works for cleaning and coloring molten glass, for glazing, and in every process that would deal with manganese. Workers in dusty atmospheres both inhale and swallow dust particles. The absorption is usually prolonged, taking four months or more before symptoms appear. In the case which I have reported, 14 months elapsed before the man noticed symptoms. It is a slow acting poison. Chronic poisoning never develops as fast as with lead. On account of the chronicity it is impossible to fix the amount of manganese dioxide causing the symptoms. Manganese is found normally in the blood of men, .01 to .025 mgm. per 100 gms. of blood. It is found in nearly all the organs of the human body from traces up to .02 of a mgm.

TREATMENT: Stanley Barnes and Weston Hurst[3] have described a series of four cases of hepatolenticular degeneration in one family, which seems to prove conclusively that the nervous symptoms never occur until the liver has become grossly diseased. Charles,[4] with the idea that the liver may secrete hormone which may act beneficially on the brain, treated seven cases by feeding liver. His reported results of the treatment were, on the whole, as might have been expected, disappointing in long standing cases. However, when a patient has improved after taking liver, this improvement has set in with remarkable rapidity, within the first few days of its administration, and this amelioration of the symptoms has been maintained while the patient continued the liver treatment. No case has been cured by this method. No matter what treatment is instituted there seems to be little hope for recovery. Workers in manganese seem especially prone to die of pneumonia. I treated this patient with one gram of sodium thiosulphate intravenously every other day. While in the hospital he appeared to have some beneficial results. However, he has lapsed back into the same condition as when he first came under my observation.

3. *Brain*, 1926, 49, 36. 4. *Brain*, 1927, 50, 30.

SUMMARY: A brief report of a case of manganese poisoning:

The diagnosis of manganese poisoning is made upon the following points:

1. Occupational history of having worked in manganese dust.
2. Lack of energy and mental languor.
3. Emotional instability.
4. A Parkinsonian mask-like expression.
5. A low-toned monotonous voice.
6. Tremors of hands, arms, legs, head and trunk.
7. Walking with stiff gait on a wide base.
8. Propulsion, but retropulsion is more frequent.
9. Cramps in the calves and stiffness in the muscles of the legs after trying to walk.
10. The deep reflexes are increased.
11. Romberg's sign present but not a constant finding.
12. No sensory disturbances except in early stages.
13. Sweating, particularly at night, and salivation may be increased.
14. No abnormal changes are noted in the cranial nerves, pupils, fundi or sphincters.
15. No abnormality in the urine, except in some early cases.
16. The blood chemistry normal except cholesterol and manganese were high.
17. The blood counts are reported to be lower (in my case found to be normal).
18. Spinal fluid was normal in every respect and showed no trace of manganese.

New Publications

THE classification of x-ray changes found in silicosis, as prepared by a committee composed of Drs. Sayers, Pancoast, Pendergrass, Lanza, McConnell, Riddell, Sampson and Gardner is to be published at an early date. These men, in Dr. Geo. G. Davis' Pneumonokonioses (Silicosis) Bibliography, have among them 85 references to articles prior to 1934. This number will be considerably increased in the REVIEW OF THE PNEUMONOKONIOSES (SILICOSIS)—LITERATURE AND LAWS OF 1934, Dr. Davis' second book, already announced and now on the press; the new book will include their 1934 articles.

DR. HART E. FISHER's Medical Department Manual, which was published serially in *Industrial Medicine*, concluding with the Sections in the June, 1935, issue, is to be ready soon in book form. It is to be published by *Industrial Medicine* in the near future.

INDUSTRIAL MEDICINE, by W. Irving Clark, A.B., M.D., and Philip Drinker, S.B., Cm.E., one of the National Medical Monographs, edited by Dr. Morris Fishbein (National Medical Book Company, New York), is just off the press. This book, together with DISEASES OF THE CHEST, by J. Arthur Myers, M.D., another of the National Medical Monographs just published, will be reviewed in an early number of *Industrial Medicine*.

The Doctor and the Cost of Hiring

—Being Chapter I of an Inquiry into the Elements of the Indirect Costs of Labor—

SHOW this title to any hundred industrial executives and you will be surprised at how many more than half of them will succumb to the temptation of the obvious—either asking you what the doctor has to do with the cost of hiring, or answering the question without asking it by stating that he probably hasn't much to do with it, except as he may be instrumental in increasing it through pre-employment physical examinations.

Or, because you have a better understanding of human nature than most people, maybe you won't be surprised.

But whether you are surprised or not, you will be highly susceptible to the conclusion that the extent to which too many industrial executives are interested in industrial medical matters is only the extent to which such matters are very obvious.

But wait! Among your hundred executives, you encountered a few who didn't say anything at all; their eyes had a far-away look, such as you see when the mind behind the eyes is working at high speed. Those men were beyond the obvious —searching for a possible significance in this apposition of the industrial physician with the cost of hiring—wondering what that significance is, and if it would be worth while to dig it out.

For the obviousness of the title is more than tempting, it is also tricky. The obviousness is *too* obvious; the discerning mind will perceive instantly that there is not only something said, but also something suggested; not only something apparent, but also something hidden.

What is it?

COST OF HIRING is a good place to begin. This cost has several important elements.

The phenomenon of labor turnover exists because employees quit, or are discharged, or die—leaving, in any normal working force, vacancies which have to be filled in order to keep the force at the normal figure.

The first element of the cost of hiring is found in the fact that "vacancies do not fill themselves, and they are expensive from any angle. Whether the employee is replaced from within the ranks or from outside the organization, the normal routine of the going business requires the hiring of a new worker and the necessary training to enable him to fit in somewhere along the line. The cost of the hiring and the cost of the training, together with the cost of the internal adjustment to accommodate both, make up a unit of the cost of labor turnover which every employer is compelled to absorb to a greater or less degree—none being able to avoid it and only a few being able to minimize it . . . The operation of hiring involves the immediate expense of taking the new employee into the service, the subsequent expense of training him, and all the incidental expense of making him fit into the productive routine. 'It is quite obvious that there must be a heavy expense attached to the constant breaking in of new employees. This expense is enormous, even without considering the cost of spoiled work, decreased production, and industrial accidents which inevitably follow as a result of this everlasting shifting'.[1] Employers have borne with the fact that the entire process is costly; they have not attempted, until very recently, to express its cost in terms of individual employees. There is authority,[2] however, for the statement that the cost of taking on a new employee is at least $100."[3]

The second element of the cost of hiring comes from the relation of the normal working force to the number of *full-time jobs* represented by the employment situation.

One job filled by one man for one year, without interruption from any cause whatever—that is a full-time job. The job of the president of an industrial organization is an excellent example; in the highest sense of the term, he is a full-time worker.

"Industry," however, must not be considered as meaning any particular type of endeavor or group of enterprises. It is not limited, in any such sense, for example, as to include "manufacturing industries" only.

"Industry" means not only everyone and all of the conditions wherein there is a contractual exchange of work for wages (or salary) and wages (or salary) for work, but it also goes further and includes the one-man enterprise.

The latter, however, is not particularly useful here except as it illustrates that fact that "industry" is a matter of "jobs"—the aggregate of industry in the nation is the aggregate of the jobs in the nation.

The one-man business has one job. The novelist, typing his own *mms.*, is a good example. He produces something which is his own creation, and he sells it. He is completely identified with his job; it is his and his only; no one else can do it.

The situation in which there are two or more jobs may be illustrated to start with, by the owner of two trucks which are on a regular hauling schedule and which, because he can't drive them himself, he must man with two drivers. This owner's income depends upon the regularity of the hauling schedules; the trucks must be manned.

Here begins the separation of identities as between the jobs and the men who fill them. If Pete Smith, on one truck, can't make the run today, John Jones is able to do it.

The significance in this separation of identities is this: that, for the week in which Pete Smith laid off from one trip, the owner—with the two trucks to be kept going, the two jobs to be filled—has three names on his payroll.

Although there are only *two* jobs here, expand this to the railroad train which must run on schedule, the newspaper, which must come out on time,

1. Labor Turnover in Industry, by Brissenden and Frankel, p. 116.
2. "Mr. James D. Hackett, in his report to the American Management Association, estimates that the annual turnover cost in manufacturing industries is responsible for an average cost—in breaking in new employees, spoiling materials, etc.,—of $100 per new man hired." The Tragedy of Waste, Stewart Chase, p. 132.
3. Pensions in Modern Industry, pp. 433, 438.

the play, which "must go on"—and the picture is still of the definite normal number of jobs which, like the truck drivers' jobs, are indifferent to the identity of their incumbents, provided only the incumbents are qualified to do them. But the picture is also of the definite number of jobs which require a force of more than the same number of employees to keep them filled.

These, therefore, may be stated as premises:

1. In every employment situation where people are hired to do work, the business and/or the equipment require a minimum number of employees in order to operate.

2. This minimum number of employees required is the exact number of jobs which the situation offers. (This number of jobs varies, of course as between times of good and bad business conditions.)

3. The number of employees on the payroll will be the number needed to keep all the jobs filled.

4. And at any time the number of employees on the payroll needed to keep all the jobs filled will be—(as the truck owner found it when Pete Smith laid-off from a trip)—*larger* than the number of jobs which need to be filled.

This relation of the normal working force to the number of full-time jobs is illustrated by Table 1.[4]

Establishment	Number of Full-time Jobs	Number of Employees on Payroll	Excess of Employees
Copper mine	247	298	21%
Smelter	391	506	29%
Electro-zinc plant	138	185	34%
Machine tool mfg.	3,855	4,046	5%
Metal products mfg.	1,047	1,151	10%
	5,678	6,186	

Table 1. Relation of Number of Jobs to Number of Employees Necessary to Keep Them Filled

On the basis of these figures it may be expressed as:

10 full-time jobs: 11 employees;
100 full-time jobs: 109 employees;
1,000 full-time jobs: 1,088 employees;
10,000 full-time jobs: 10,877 employees: etc.

But the variations between different kinds of work are so great—34% excess in one as compared with only 5% in another (Table 1)—as to make an algebraic form more suitable. For this reason, and other reasons which will later more fully appear:

Let A = the number of full-time jobs; and
A+a = the number of employees required to fill them.

WE NOW have A+a employees on the payroll. How long will they stay there?

Table 2[5] is indicative of the answer to this question. It is a fair representation of what happens, as to continuity of service, in every sizable working force. Ask any pension actuary.

There is nothing obvious in Table 2 to show that, in order to maintain a working force at normal, it will be necessary to hire each year, from 65% to more than 100% of the normal number of employees. Yet that is exactly what the conditions illustrated by Table 2 mean; the figures of the Table work out at 76.11%.

4. Labor Turnover in Industry, by Brissenden and Frankel, p. 10.
5. Labor Turnover in Industry, by Brissenden and Frankel; Pensions in Modern Industry, p. 433.

This, for any year except one of real depression, is rather conservative. Brissenden and Frankel's studies of 84 manufacturing, merchandising and utility establishments show an 89% average; one business (mail order) required 93%; and five manufacturing concerns, with full-time jobs averaging just over 10,000 each, required 97%. Stewart Chase[6] says: "Mr. Hackett's figures of 9,000,000 employed in manufacturing industries work out to a turnover ratio of better than 80%—which seems to be rather under than over the generally accepted ratio for modern industry as a whole. Broadly speaking, turnover studies show that for every 10 men on the payroll at the beginning of the year, 10 new men are hired and 10 old men are fired (or quit) during the year, to keep a force of 10 men still working at the end of the year—or a turnover ratio of 100%. Florence, in his 'Economics of Fatigue and Unrest,' shows that the rate of turnover in American factories from 1910 to 1919 has varied from 63 to 201% per year, and maintains, furthermore, that with proper management, turnover should not exceed 25% per year. In the metal trades industry the Hoover engineers found an annual turnover of 160%, with one plant running up to 360%. On the Great Lakes the turnover in passenger and freight steamers reached, in 1917, the phenomenal total of 818%. The turnover in railroad maintenance work is in the neighborhood of 200%, while for railroad conductors it is only 5%—showing the tendency for turnover to increase as work becomes progressively unskilled. The average annual rate of turnover in England has been estimated at 111%." Bureau of Labor statistics for the year 1934, referring to 144 industries, show 49.17% separations.

And so, with our working force at A+a, the yearly number of hirings will be .7611 (A+a).

Why are so many hirings required? In other words, why do so many employees leave?

Table 3[7] is a pretty good cross-section of the answer as to causes exclusive of mortality. The relation between the "quits" and the "discharges" is about five to one; the "quits" will average a little better than 80% of the number whose yearly separations from the payroll make the yearly hirings necessary.[8]

This Percentage	Will Remain on the Payroll an Average of	With a Service Period of
27.43%	6 months	1 year and less
13.81%	1.5 years	1 to 2 years
11.66%	2.5 years	2 to 3 years
15.94%	4.0 years	3 to 5 years
8.12%	6.0 years	5 to 7 years
9.50%	8.5 years	7 to 10 years
7.69%	12.5 years	10 to 15 years
2.66%	17.5 years	15 to 20 years
3.19%	20.0 years plus	more than 20 years
100.00%		

Table 2. Indicative of the Average Length of Time Employees Remain on a Payroll

The conditions illustrated by Table 3 always have two characteristics which may be noted here. One is that a percentage of the "quits" are for "health reasons"; the other is that there is no discharge for "health reasons." As to the former, the

6. The Tragedy of Waste, p. 132.
7. Labor Turnover in Industry, by Brissenden and Frankel, p. 99.
8. In six metal trades establishments studied by Brissenden and Frankel, this average was 5.7%; in a department store the "discharges" were 11% of the "quits," and 13% of the number of full-time workers.

6% of Table 3 is about the average. As to the latter, employers are very reluctant to dismiss employees for purely physical causes.

NOW we can go back to the yearly hirings. Employees to the number of .7611 (A+a) will be taken on *this year*. They will be put through the hiring routine — will answer some more or less important questions—but *medically* they will be unselected.

Reasons for Leaving	Percentage
Other positions:	
More promising positions	15.2%
Better salary	8.1%
Former position and return to trade	2.0%
Going into business	.3%
To learn trade	.4%
Position nearer home	.5%
Leaving city	15.0%
To marry	1.7%
On account of health	6.0%
Dissatisfied:	
With working conditions	5.5%
With salary	1.6%
Work too hard	2.0%
Resented criticism	1.0%
Refused to be transferred	.8%
Refused temporary work	.7%
Did not like supervision	.5%
Distance too great	.7%
To go to school	4.1%
To stay at home	5.9%
No reason (failed to report)	28.0%
	100.0%
Unsatisfactory:	
Too slow	27.1%
Indifference	12.4%
Carelessness	9.0%
Irregular attendance	10.8%
References	2.0%
Dishonesty (suspected of pilfering, etc.)	16.6%
Insubordination	11.5%
Drinking	2.8%
Fighting	1.5%
Financial difficulties	.5%
Enemy aliens	.3%
Other causes	5.5%
	100.0%

Table 3. Some of the Reasons Why, and Some of the Ways in Which, Employees Are Separated From Payrolls.

What are they bringing with them?

Each one, of course, is bringing the need for a certain amount of training for, and adaptation to the environment of, the new job. This is only to be expected. But remember, it will cost the employer $100 before the new man becomes a productive unit. [Cost of hiring, thus far, $76.11 (A+a)].

What else are they bringing with them?

Each one brings his personal equation. This—compounded of heredity and background, temperament and education—will become manifest in his future relation to his job, and will be the deciding factor in whether he quits, or is discharged, or remains on the payroll.

But what else?

If you, doctor, had been able to give each one of the .7611 (A+a) employees who are on the payroll *before he or she was hired* the kind of physical examination which Dr. Marshall J. Payne[9] calls "searching" you would have found that they were bringing certain physical conditions. But you didn't examine them before they were hired, and so there they are—on the payroll, where we can leave them until Chapter II begins to find out what the physical conditions they brought with them were.

[9] Modern Industrial Surgery by MARSHALL J. PAYNE, M. D., *Industrial Medicine*, March, 1935, p. 136.

Peritoneal Tissue and Dust

CALCITE, limestone, precipitated calcium carbonate, gypsum, and Portland cement, after being injected into the peritoneal cavity, formed irregular, more or less discrete nodules.* In the earlier stages, some congestion and edema was noted about the edges of the nodules. This irritation was relatively slight in all of these dusts except cement, where it was quite severe, due possibly to the chemical qualities of the dust. The initial stage of foreign body irritation had subsided before the end of 30 days after injection. The nodules became progressively smaller as the interval between injection and examination increased; and the decrease in size was accompanied by the production of a fine brown pigment, which appeared at the edges and on the surfaces of the nodules. Gypsum alone of these dusts did not cause the formation of the pigment. The original dust eventually disappeared, leaving only brown pigment particles at the sites of the nodules. Later the pigment likewise decreased in quantity, and in some animals disappeared entirely without the formation of scar tissue. This response, consisting of the disappearance or dissolution of the dust from the tissues has been designated, for the sake of description, as one of absorption.

Quartz and chert, after an initial stage of foreign body irritation similar to that noted in the previous group of dusts, produced nodules which became progressively larger in size. These nodules showed a tendency to fuse together. They presented the gross and microscopic appearance of cellular proliferation. The increase in size continued to progress up to 90 days after injection, after which it remained constant. The nodules then became more indurated and fibrosed. At the end of 360 days fibrosis was well marked. This type of reaction has been called one of proliferation. The chert used was highly siliceous.

Soapstone, carborundum, jewelers' rouge (hematite), anthracite coal, bituminous coal and precipitator ash produced the same type of foreign body reaction in the first two weeks as was noted with the other dusts. The early fixation reaction was not severe and subsided quite rapidly. The nodules, at first raised and rounded, became flattened and spreading with irregular edges. Numerous fine isolated particles were noted in the peritoneum adjacent to the nodules. Collections of dust particles were found at various other points in the peritoneum. The amount of dust found in the peritoneal cavity 360 days after injection was approximately the same as that noted in seven days after injection. The injected dust was neither absorbed nor did it initiate a cellular proliferation. The only change noted was that of the distribution of the dust in the peritoneum. This type of reaction has been classed as one of inertness.

*DRS. R. R. SAYERS, J. W. MILLER and W. P. YANT, in *American Journal of Public Health*, April, 1935.

The tissue of the peritoneal cavity responds actively to a dust introduced as a foreign body, the response being of such a character that it may be used as a basis for the classification of industrial dusts with reference to their pneumoconiosis producing properties. This response falls into three groups: absorption, proliferation, and inertness. While the animals were kept on test for as long as 360 days, the response was sufficiently well marked in 90 days to determine the type of reaction, and, often, conclusions could be reached in 30 days, particularly if the reaction was one of absorption or proliferation. The reaction produced by each dust was constant and uniform in all animals injected with that dust. It appears that this response of the peritoneal tissue to various dusts can be used to indicate the possible harmfulness of an industrial dust.

Volatile Solvent Hazards

—And How They May Be Minimized—

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OF RECENT years, volatile solvents as a class have been finding wider and wider fields of usefulness in industry, and new solvents are being introduced with little or no consideration of their potential toxicities.

Under volatile solvents may be included the alcohols, especially methyl alcohol; benzol and its homologues toluol and xylol, and their derivatives especially nitro- and amino- compounds; carbon bisulphide; the chlorinated hydrocarbons, such as chloroform, trichlorethane, tetrachlorethane, tetrachlorethylene, ethylene dichloride, and carbon tetrachloride; petroleum and petroleum products; the aliphatic hydrocarbons; phenolic derivatives; ethylene oxide; the glycol ethers; and other as yet less generally used materials.

The use of such products in open processes, or in supposedly closed but in reality leaky systems, not infrequently gives rise to serious or fatal cases of poisoning, and so gives a bad name to these materials, which may usually be employed with safety if their physical and toxic properties are understood and respected.

It is my aim to discuss this class of solvents as a group with similar properties and uses, and to outline methods of handling such solvents so as to minimize their potential harmfulness, and also to enumerate methods of protecting workers so that no serious harm may come to them from the vapors.

The first consideration should be the selection of workers on the basis of pre-employment examinations, with due consideration of the usual effects of such materials. In high concentrations they are apt to be narcotic depressants and frequently distinctly irritant to the lungs, so that those with functional or organic heart lesions or chronic bronchial inflammations should be excluded.

In moderate concentrations they may cause blood changes affecting any of the cellular elements of the blood, or, as do nitro- and amino-compounds, they may alter the hemoglobin content; so normal or nearly normal blood pictures are desirable, and any marked variations from normal blood findings should be contraindications.

Many or all of these materials may be skin irritants, and, as they are usually lipoid solvents, they are absorbable through the skin, as well as by inhalation or mouth ingestion, and some of them may be quite toxic when so absorbed. Workers with skins especially sensitive to irritants might well be excluded, and dermatologists are beginning to recommend the use of patch testing in pre-employment examinations, using the materials to which workers will be exposed.

Long continued exposure to many of these materials, in addition to upsetting the digestive tract, may produce degenerative changes in the glandular organs, especially the liver and kidneys, resulting in fatty liver changes, and, with the chlorinated hydrocarbons at least, in hepatic cirrhosis, and also in chronic renal changes. So those with histories of digestive tract disturbances, of jaundice or other liver changes, and of nephritis should be excluded.

Some of these materials, because of their lipoid solvent properties, are especially prone to affect the nervous system, and any pre-existing abnormalities of mentality or of the peripheral nervous system should be a matter of record, if not considered a reason for non-employment.

Obese men and alcoholics are bad risks with many of these solvent materials. A number of cases of serious poisoning from carbon tetrachloride have developed in alcoholics, when fellow workers not so addicted to alcohol were not affected or were lightly affected by the same apparent exposure.

HAVING selected healthy normal workers for subjection to solvent exposures, it is important that they be kept healthy by regular living and adequate diets, and here the plant restaurant with a supply of well balanced diets can be of great service. In experimental work with animals, diet has been found to have great influence in protecting from solvent effects. Dogs on adequate high-protein and carbohydrate diet resist carbon tetrachloride concentrations sufficient seriously to affect or kill those on an incomplete diet, especially if the latter is rich in fats. Milk should be an essential in the diet of workers exposed to chlorinated hydrocarbons, to maintain blood calcium.

Having done what we could to select a good type of worker and to keep him in good condition, and to minimize his exposure by methods to be discussed later, we should not assume that he will be unaffected by even moderate exposures, but we should assure ourselves that our precautions are effective by periodic medical examinations, the frequency to be based on the known toxicity of the material and the degree of exposure, and the type based on the effects of the particular solvent if known.

At all events, such examinations should include red and white cell counts, differential counts, and hemoglobin determinations, and routine urine examinations.

For particular solvents, additional tests may be indicated, as Van den Berg test, icteric index, and bile pigment in the urine for solvents affecting the liver, and urinary sulphates, total and inorganic, for benzol and probably also for chlorinated hy-

* Read before the Section on Public Health and Industrial Medicine, Philadelphia College of Physicians, at a special meeting in honor of the American Association of Industrial Physicians and Surgeons, June 10, 1935.

drocarbons; as well as specific tests for the excretion of the solvents where such tests are recognized as practical. Basophilic aggregation or stipple cell counts may also be indicated.

In any case, these examinations should be thorough and should look for specific indications of harm, rather than being mere routine checks on general health. Wirtschafter has suggested that plotting of visual fields may be servicable in detecting early carbon tetrachloride damage, but this test has little value unless carried out by a trained observer.

Periodic examinations may be repeated from every three weeks, as is done with tetraethyl lead workers, to every six months or every year, but never less often than yearly when there is any possibility of volatile solvent exposure.

IN CONSIDERING the protection of the carefully selected worker by controlling working conditions, the most adequate protection, of course, is the use of entirely closed systems for handling the solvent. The manufacturers of these substances often do not realize their potential hazards, as they, for economic and other reasons, usually employ all closed or nearly closed processes.

As one manufacturer of benzol said to me years ago, "if we permit benzol vapor in toxic amount to escape into and around our plant, we are losing money. We make it to sell at a profit, not to smell." The user of these materials, on the contrary, accepts some loss by evaporation as inevitable, and often as essential to accomplish the desired results, and, unless he realizes the danger, is apt to be careless as to where, how, and to what extent he permits such evaporation to occur.

Closed processes, while ideal, are not always completely possible. But at least the evaporation may be controlled, and limited to a certain place or time in the cycle of operations, and at such time and place adequate exhaust ventilation from the point of production of the vapor or fume may care for the hazard.

There is but one measure of adequacy in this case, and that is periodic measurement of vapor concentration in the breathing zone of the worker.

Failing this, however, the trained sense of smell may be a great help. Not the sense of a worker, foreman, etc., constantly exposed to the fume, but that of a normal nose coming in from a known vapor-free atmosphere. The sense of smell is one of the most easily tired reactions, and is not adequate protection if exposure is continuous. Unless toxic limits are known, it may be a safe assumption that if its odor is easily recognized as in any more than traces by the average observer, the solvent is present in the air in potentially unsafe amounts, at least for continuous exposure. In most cases concentrations several times that of safety for continuous exposure may be borne with impunity for short periods, and where other methods fail to control the hazard sufficiently to make continuous work safe, the worker may be, at least in part, protected by adopting short shifts of daily exposure, and occasional intermissions of a number of days.

Where adequate exhaust ventilation cannot be provided, it being also essential for the employee to work in the presence of toxic concentrations, the positive pressure air mask or helmet may be used, with air supply from an assured uncontaminated source. By means of a feed tube coming from above, and possibly a flexible feed on the end of a swinging metal arm, considerable range of motion can be provided for the worker.

Absorbent respirators without clean air supply should be reserved for emergency use when large amounts of vapor escape through accident, or for intermittent use over comparatively short periods, and if used, someone should be responsible for their proper upkeep.

Where anything less than completely adequate exhaust ventilation is in use, and masks are necessary, it is essential to isolate the process so that only protected workers are exposed.

With exhaust ventilation for removal of vapors it is important to discharge the contaminated air at a point where it will not endanger others, and where there is no possibility of its being brought into the working area again.

Exhaust ventilation should always be with strong enough pull to remove fume at least as fast as it may be produced. This will not be done unless the intake hood is placed as near as possible to the point of vapor production, and is so shaped that all or almost all of the air exhausted passes over the fume area. Wide open hoods at a distance from the point of fume production, or powerful unhooded fans are given an impossible task, and figures of efficiency based on cubic feet of air handled, or calculated air changes per minute or hour, may be very misleading.

SOLVENTS with vapors heavier than air may be safely handled in open vats if the vats are not too wide, and if they have powerful slot type exhausts surrounding the top of the vat. This makes it possible to dip and extract from open vats, provided the extracted materials are well drained over the vat and hung to dry over a slotted floor with downward ventilation. In some cases it may be desirable to provide protection for drained material in transit to the drying floor, particularly if it has to traverse other departments or working areas. With heavy vapors, a trough or bucket under the suspended material and partly surrounding it may suffice. Downward ventilation should always be used for heavier than air vapors. Exhaust ventilated spray cabinets should have as small a front opening as is consistent with the type of work, and should be deep enough so that the work does not project materially beyond the front opening. Unhooded exhausts behind flat surfaces may be feasible, but they are far from economical, owing to the large amount of air they must handle. A point often overlooked is that open doors or windows, with their resulting positive or negative pull, in the near vicinity of exhaust fans, are sure to upset calculations as to air currents, and may change a protective device into a positive hazard.

It should never be assumed that any exhaust system will continue to prove adequate without proper upkeep, and adequacy should be checked from time to time by air sampling of vapor concentrations.

BEFORE closing, a word should be said about protective clothing. Be sure that such clothing, especially gloves and shoes, does not merely serve to poultice irritant or toxic material against the skin.

As a rule, the use of protective ointments for

the hands, arms, or face is better than gloves, etc. For oil solvents, the so-called vegetable gloves, several types of which, I believe, are on the market, are excellent, providing a protective non-oil-soluble film easily removable by soap and water at the end of the work period. I would warn against the use of these solvents for cleaning hands and arms after work, unless followed by free use of soap and warm water.

In conclusion, I would caution against the hasty introduction of new volatile materials in industrial processes without first determining as well as possible their toxic potentialities. If the methods as outlined in this paper are employed, it should be possible to use even highly toxic volatile liquids with a reasonable degree of safety.

To sum up:—

Know your hazards;
Select your workers;
Protect your workers; and
Check frequently on health, and on efficiency of protection offered.

Industrial Hygiene Problems

FOR the sake of simplicity, the different plants are grouped into 10 main industries,* metal products industries; printing and allied industries; chemical industry; clay, glass and stone; leather industry, dying and cleaning; electroplating; storage battery; rubber goods, and fur preparation. Of 28,686 workers covered in this survey, 22,610 (78.8%) were males.

The percentage distribution of the plants according to the number of employees shows that nearly half (48.7%) of the plants employed less than 10 workers, while 10.2% had 100 or more.

It is well known that numerous materials and conditions incidental to industrial processes are causative factors in the production of occupational diseases. Dublin and Vane list some 94 groups of industrial poisons in the United States, associated with about 900 different occupations. In view of the influence these materials and conditions may have on the health of workers, one of the most important tasks undertaken in the present inquiry was the recording of raw materials, processes and finished products associated with each occupation encountered in the 615 plants under consideration. Some 50 varieties of materials and conditions were encountered, of which 11 may be placed in the category of a minor exposure, since experience has shown that no cases of systemic poisoning have ever been associated with the handling of these 11 materials. It should be pointed out that the *data on occupational exposure to these materials and conditions must not be interpreted as signifying that the workers were being subjected to toxic amounts of hazardous materials, for no quantitative studies of the workroom environments were made. The data merely indicate the potentialities present in the plants studied.*

Inorganic, non-metallic dusts, of which there were six varieties, had the largest number of exposures, 7,862 (27.4%). Carbon monoxide came next, with 19.3% of the workers exposed, while lead compounds accounted for 10.2% of the total exposures.

In order to form an idea of the entire problem concerning the handling of various materials in the plants covered in this survey, the data were prepared in a manner to show the number and per cent. of contacts in the five major industries, using only those materials in which the exposures were 10% or more. It is quite clear that in the metal products industry dusts of the types listed, carbon monoxide and lead compounds constitute the major potential problems; in the printing industry lead compounds, carbon monoxide, aniline compounds, and benzine are of importance from the standpoint of the population covered; whereas in the chemical plants the list includes dusts, lead compounds, aniline compounds, turpentine, manganese compounds, and benzine. In the clay, glass and stone industry only one substance stands out —dust, while in the leather products industry benzol is apparently the only material of importance from the viewpoint of the number of exposures. It is apparent that dust is still one of the most important materials of industrial hygiene significance, with carbon monoxide, and lead compounds closely following. It is of signal importance to point out that, at least so far as the remainder of the United States is concerned, the largest number of cases of occupational poisoning have been due to these same materials. It is the feeling of the writers of this report that the problem confronting the health officials and industrialists of this area is made manifest by the results of this study.

*J. J. Bloomfield and W. Scott Johnson, in *American Journal of Public Health*, April, 1935.

Human Anthrax

ANTHRAX,* the once prevalent human scourge due to infection with B. anthracis, a resistant spore-forming anaerobe, is rarely brought to the attention of present day physicians. Regulations governing meat inspection, the sterilization of bristles at shaving brush factories, and industrial precautions for those working in tanneries, wool sorting establishments and packing houses, have all tended to reduce the prevalence of anthrax.

In swine the usual case of anthrax appears as a malignant, edematous pharyngitis. A Grand Island, Nebraska, farm woman thought that one of the pigs on the farm "had a bone in its throat." The animal was killed and rendered for soap. Two days later two of the family cats died on the farm after consuming meat trimmings. Within a few days the woman noticed a lesion on her hand which was thought to be a flea-bite. This vesicular lesion spread rapidly and she presented herself to Dr. W. D. Magrath, of Grand Island, for treatment. The lesion asumed a blue-black color, raised formation with quick involvement of the lymphatic and axillary lymph glands. Ecchymotic hemorrhages appears in the axilla. Stained smears from the hand lesion revealed the typical long, chain-like strands of vegetative anthrax bacilli. Dr. W. J. Moslander, D.V.M., Grand Island, confirmed their identification. The patient received liberal doses of anti-anthrax serum and made a good, though somewhat slow recovery. The two cats that died on the farm after eating the hog meat were iced and sent to the State University laboratory at Lincoln. Both showed positive anthrax.

* Dr. A. H. Quin, Jr., in *The Journal of the Iowa State Medical Society*, December, 1934.

Endocrinology & Industrial Medicine

—The Importance of Endocrine Consultation—

by

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ENDOCRINE disorders are so numerous that every practitioner of medicine is confronted by many of them. Unfortunately, endocrine literature is so voluminous that even the man especially interested in this field has difficulty in keeping abreast of it. At this time it is dominated by the experimental physiologists to the point that the value of a careful, detailed history and physical examination is lost sight of, and yet in no other field of medicine is a careful history so important. While not every patient needs to be carefully studied to exclude endocrine disorders as a source of his trouble, the following suggestions are offered as indications for an endocrine study:

1. Cases in which the diagnosis is not well supported by laboratory or clinical data.
2. Cases in which the diagnosis seems well established but the indicated treatment fails to achieve the results the doctor has a right to expect.
3. Cases in which the diagnosis of Graves' disease is in doubt.
4. All cases of ill-defined "nervousness," neurasthenia, narcolepsy, migraine and "hyperinsulinism"—this is probably more often due to pituitary and adrenal insufficiency than to hyperfunction of the pancreas.
5. Menstrual disorders not clearly due to local conditions within the pelvis.
6. Essential hypertension and diabetes mellitus.

Importance to Industry

ON THE railroads and in industry, where members of the operating department are subjected to periodic examinations, the question of endocrinopathies should be seriously considered, and the examiner should be sufficiently well informed in this field of medicine to note certain outstanding signs of endocrine disorder in the history and physical examination.

Undoubtedly the financial welfare of many corporations would be improved if the personnel in the managerial departments were subjected to occsional examinations with the idea in mind that loss of efficiency, lack of initiative and a general let down in some executives might be due to an endocrinopathy which could be readily corrected.

Not only in the examination of new applicants for employment, but also in the reexamination of old employees, the examiner should bear in mind that endocrine disorders write their signatures on the stature of the patient and on the skin and its appendages—the hair, nails and teeth.

Questions as to the reaction to hot or cold weather give considerable information. The victim of thyroid insufficiency is very sensitive to cold but likes hot weather. He sweats very little. The victim of hypoadrenia is sensitive to both heat and cold and is probably more adversely affected by extreme heat than by very cold weather. A loss of mental or physical efficiency should lead to an investigation of the thyroid, pituitary and adrenals. Thyroid failure particularly affects adversely the mental as well as the physical side of the patient. Increasing difficulty in getting along amicably with officers or employees is often due to thyroid or gonadal insufficiency. These facts can be developed by a few diplomatic questions in the course of a routine examination, and the medical officer can at once recommend a more detailed study.

That the medical department soon learns to use the endocrinologist with increasing frequency is indicated by the writer's experience with the Illinois Central Railroad. The appointment was made in the early months of 1930. Cases were seldom referred oftener than once a week during the next year or so, but in 1934, 211 patients were seen in the office and 31 in the hospital—and this in spite of the fact that there had been a considerable reduction in force on the railroad.

These have been cases of nervousness, suspected gall bladder trouble, menstrual disorders, one or two cases of obesity, a few of hypertensive heart disease and a considerable number of essential hypertension and diabetes mellitus.

The majority of these cases have had a pituitary factor—that is, the pituitary alone, either or both lobes; the pituitary and thyroid in a few; the pituitary and ovaries; or the pituitary and the adrenals. In the Illinois Central Service pituitary disorders have been readily amenable to treatment and the patients' disabilities so corrected. At the Elgin State Hospital about the same percentage of pituitary cases is found, but treatment of the pituitary disorders seldom helps the patient's mental status. However, in the same institution patients having gonadal disorders respond to treatment with improvement in their mental status.

The pituitary appears as the master gland, setting the pace for all the others. The old idea that endocrinopathies were always monoglandular affairs, if the doctor were only smart enough to locate the one at fault, has always appeared erroneous to the clinical endocrinologist. The work of the experimentalist now makes it appear ridiculous.

In the past two years at the Illinois Central Hospital we have been treating cases of essential hypertension and diabetes mellitus by exposing the pituitary and adrenals to very small doses of the x-rays. This treatment is based on the belief that these syndromes are due, in most cases, to a disordered function, probably in the nature of hyperactivity, of these two organs, which could be corrected by the x-ray.

Many cases of essential hypertension that received an adequate amount of treatment have experienced marked improvement; that is, they have been relieved of their disagreeable symptoms and their blood pressure has been very materially reduced.

The following table exhibits the results:

	Men	Women	Total
Improved	62	35	97
Unimproved	19	6	25
Insufficient treatment	25	8	33
Cannot follow	4	5	9
	110	54	164

Hypertension (110 men and 54 women)

The following factors are used: 120 kilovolts, 2 mm. aluminum filter, 50 cm. skin target distance, 10x10 cm. portal to each side of the pituitary, 15x15 cm. common portal to the adrenals, 4 milliamperes, 7 minutes, 70 R units. Except under special circumstances treatment is not repeated oftener than once a week. The interval between treatments is longer if the blood pressure shows a favorable response. For example, if the blood pressure drops after one treatment from 250/150 to 200/100, no further treatment is given until it is evident that no further drop can be expected or until the pressure begins to rise. One man in coma from a subarachnoid hemorrhage had a drop after treatment to 170/80. In three days the blood pressure rose to 210/110, and another treatment was administered to the adrenals only.

Eighteen patients have been treated who had both hypertension and diabetes. The results are shown in the following table:

	Men	Women	Total
Both conditions improved	5	2	7
Hypertension improved	2	2	4
Diabetes improved	2	1	3
Insufficient treatment	3	0	3
Cannot follow	1	0	1
	13	5	18

Hypertension and Diabetes (13 men and 5 women)

Where the patient has diabetes mellitus only, there has been a marked improvement in carbohydrate tolerance in approximately one-third of the cases. A number have been able to discontinue the use of insulin, and others have reduced it from 60 units to 20 units per day. This work has already been reported elsewhere.[1 2 3 4]

Some of the service the endocrinologist can render to industry is illustrated by the following typical cases:

Cases

MR. L. J., in the service 38 years, had an attack of "flu" early in June, 1933. Following that he complained of anorexia, nausea, backache and pain in his hips. Physical examination was essentially negative, and the only significant laboratory finding was a basal metabolic rate of minus 29% on one occasion and minus 20% on another. Because of this he had been given thyroid. While taking very small doses of this, insufficient of it to increase his basal metabolic rate to normal, he developed heart consciousness and extrasystoles.

Because of the negative physical findings, the low basal rate, his inability to tolerate thyroid and the history of a previous attack of "flu," a diagnosis was made of adrenal insufficiency, and he was given desiccated suprarenal five grains three times a day by mouth. Because of the intimate relationship between the suprarenals and the pituitary, he was also given antuitrin. On this medication he made very satisfactory improvement.

A common misapprehension is that the basal metabolic rate measures the level of thyroid function and that a low basal metabolic rate is always due to thyroid insufficiency. As a matter of fact, there are a number of other conditions that will produce minus readings. Unless such a reading is confirmed by ample clinical evidence of thyroid deficiency, the doctor should look elsewhere for the cause of the low basal metabolic rate. If it is further found that the patient cannot tolerate enough thyroid to restore his basal rate to normal without more than temporary discomfort, the doctor can be assured that the patient's primary trouble is not hypothyroidism but is much more likely to be due to pituitary or adrenal insufficiency or a combination of the two.

MR. P. L., engineer, was accused of sleeping on duty. A general check-up in the hospital failed to reveal any reason for his drowsiness. He admitted that when not actively engaged he went to sleep, and that this had been true for 15 years. The consulting neurologist stated that his examination revealed no abnormality of the nervous system. He thought the condition suggested narcolepsy, and yet it was not quite typical; and suggested that he be removed from engine service.

As a newcomer among the list of consultants, the endocrinologist saw him last as a sort of forlorn hope. The man was 6 ft. 3 in. in height. The skin was dry and cracked. The nails were brittle. The hair was dry and brittle, rather scant on the body and extremities, and on the head it receded at the angles of the forehead in pituitary fashion. The family history indicated that his mother was short and his father tall and heavy. The basal metabolic rate, which had not previously been done, was found to be minus 19%.

On the basis of previous negative findings, the family history, his height, the condition of the skin and its appendages and the low basal metabolic rate, the diagnosis of pituitary and thyroid deficiency was made. He was given thyroid one grain three times a day with instructions to consult his local surgeon every fifth day to be sure that no signs of thyroid intoxication occurred. Later he was given five grains of anterior pituitary three times a day. His improvement was immediate and striking. His attacks of somnolence disappeared, and he was shortly restored to road service.

Where both the thyroid and the pituitary are involved, the basal metabolic rate does not give an accurate picture of thyroid function. In such cases it is our practice to first give thyroid until the patient's tolerance is established. The dose is reduced 25% below that point, and continued at that level so long as needed. After the thyroid status is thus ascertained, pituitary medication is begun, either by mouth, as in this case, or by mouth and subcutaneously, using antuitrin in doses of ½ to 1 ampoule two or three times per week, depending on the patient's response to it and also on his convenience. Some patients find it difficult, if not impossible, to get to the doctor's office three times a week.

MR. M. P., a fireman, aged 32, complained of nervousness and weak spells during which his heart occasionally missed a beat. There was

occasionally a feeling of epigastric fullnes and slight nausea. He was always cold. He had been in the hospital many times, where his condition was variously diagnosed as neurasthenia, angina pectoris and duodenal ulcer.

He was 5 ft. 7½ in. in height. Temperature 97.6, pulse 68; blood pressure 85/55; blood sugar 85 mg.; B.M.R. minus 14%. There was some question as to the presence of bronzing of the skin. Certainly it was dark, but neither he nor his wife was certain that there had been any change in recent years. As an indication of adrenal insufficiency, bronzing is not an early sign, to say the least.

The diagnosis of thyroid and adrenal deficiency was based on the negative findings by previous consultants, the low blood pressure, the low blood sugar and the low basal metabolic rate. Treatment along this line entirely relieved his symptoms.

MR. G., a fireman, complained of palpitation on slight exertion, weakness, "light-headed spells," and insomnia, all of which had been present for about 10 months. He had been able to work but a few days in the previous year.

The usual thorough hospital examination had disclosed no cause for his complaints. His blood pressure was 112/65. His blood count showed 6% of eosinophils and he had an increased tolerance for galactose. His skin was quite bronzed, but he claimed that was its natural color. He was extremely sensitive to hot weather, as are many victims of adrenal insufficiency, differing in this respect markedly from the victim of thyroid deficiency who likes hot weather.

The diagnosis of adrenal insufficiency was based on the negative findings plus the eosinophilia, low blood pressure, increased tolerance for galactose and sensitiveness to heat. He was given desiccated suprarenal by mouth, four grains, combined with 1/30 grain of strychnine three times a day. Response was reasonably rapid, and he shortly went back to regular duty.

A SINGLE woman, 35 years of age, complained mainly of headache which she said had been present most of her life. It was located in the frontal and occipital regions. She complained also of abdominal pain, nausea, vomiting, constipation and lumbosacral backache. Her menstrual periods began at 15, occurred at 21-24 day intervals and lasted 3-5 days. Painful periods alternated with those less so. In the hospital it was believed that her trouble was due to some disorder in the biliary tract, although this could not be demonstrated either clinically or by the x-ray. She tolerated less than 30 grams of galactose.

On the basis of the late onset of her menstrual periods, the dysmenorrhea, the lowered tolerance for galactose, the nausea and vomiting and the absence of any clinical or laboratory signs to explain her symptoms, a diagnosis of ovarian insufficiency was made. She was given ovarian residue three times a week, and one week before her period was due this was changed to estrogen. Within three months her symptoms had entirely disappeared, she had gained 10 pounds in weight and considered herself entirely cured.

A TICKET agent, aged 33, complained of headache which had bothered her for some years. Originally it had been present a few days before the menstrual period, but for the past year had been almost continuous. The routine hospital examination plus that of the eye, ear, nose and throat department had failed to account for the headache. Medication had not relieved it in any way. She was overweight with the surplus of pituitary distribution. She had an increased tolerance for galactose. Fifteen units of pituitrin produced no intestinal reaction.

On the basis of previous negative examinations and the obesity, decreased galactose tolerance, and her tolerance for large doses of pituitary products, a diagnosis was made of hypopituitarism. She was given antuitrin and pituitrin twice a week. This shortly relieved the headache and brought about some reduction in weight.

MR. K. J., aged 69, complained of frontal headache for two years, and of dyspnea on exertion for one year. In the hospital the diagnosis was made of arteriosclerosis, hypertension and hypertensive heart disease. His blood pressure was 190/150. The glucose tolerance curve was of the diabetic type, rising to 190 mg. in one hour. There was no glycosuria. His headaches were severe and very resistant to medication. After a stay of several days in the hospital he was given an x-ray treatment to the pituitary and the adrenals. Following this his headache disappeared, and his blood pressure came down to 145/90. He has had no recurrence of headache or other symptoms.

MR. H. J., aged 53, had had diabetes since an attack of mumps at the age of 45. Hypertension had been discovered two years later. During the intervening years he had been troubled with severe headaches of almost daily occurrence, frequent attacks of diplopia, transient attacks of blindness and vertigo and diurnal somnolence. His blood pressure was 252/145. He did not take insulin and spilled sugar much of the time. His glycosuria and hyperglycemia disappeared after a few x-ray treatments directed to the pituitary and adrenals. His blood pressure came down to about 170/90. Occasionally the systolic was below 160, more rarely just above 180. There has never been a recurrence of the hyperglycemia or glycosuria, but after one strenuous trip he had a recurrence of most of the old symptoms and his blood pressure was found to be well over 200 with a distolic about 120. He had a few x-ray treatments since that time, and the blood pressure now is constantly within 10 points of 165/90.

MRS. F. I., a check writer, aged 58; her diabetes was discovered at the age of 56. She was taking 20 units of insulin per day when she came under observation. She had had a number of hospital admissions for diagnosis, for arthritis and for abscesses. She had not been able to work for two years because of her diabetes and pains in her arms and shoulders.

The letter of referral from the chief surgeon's office stated that she had diabetes, neuritis in both arms, and pyuria. Blood sugar 160 mg; cholesterol 163 mg.; blood pressure 150/80.

After three x-ray treatments to the pituitary and adrenals, insulin was reduced to 10 units per day, blood pressure was 145/85, and she began working. Ten days later the neuritis was much

better and insulin was discontinued and has never been resumed. Blood sugar determinations have been made at intervals of two or three months and have been normal on every occasion. She is working regularly, and has been since six weeks after treatment was begun. Her diet has not been changed from the one she was using when she came under observation.

THESE cases are cited to emphasize what was said in the beginning, that certain sign posts should be set up to warn a doctor when he is approaching an endocrinopathy. They are also intended to show that industrial organizations should make available to their employees adequate endocrine consultation, the same as they do surgical or other specialties.

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Circle in the Corner

WASHINGTON (D.C.) Gas Light Company's buildings, including its garage, have circles of white in the corners, up the stairways, and around pillars—every corner with a quarter of the circle painted on each of its two walls and another quarter on the floor. As one climbs the stairs or walks around in the buildings he wonders if he is not playing a game, or perhaps following a clue. Without at first knowing why, however, he refrains, at the same time, from throwing his cigarette butt in any of the corners.

It *is* a game—the oldest of all games, that of human nature. It is to keep employees and visitors from "spitting in the corner," and to correct the bad habit which uses corners for wastebaskets. That is the obvious purpose; the main idea is sanitation—cleanliness and ease of inspection: to keep matches, match pads, cigar and cigarette butts, pieces of paper, away from pillars and out of corners in halls—and thus to keep them clean; and to keep old rags or what have you, oily, perhaps, and inflammable, out of corners in shops, basements, garages, closets, storerooms—and thus to minimize fire hazards.

The circles are of no particular size, about six inches in diameter, just big enough to be obvious, depending on the cut of the corner and the strength of the light where the corner is.

Without a word, the powerful suggestion of these white circles is changing the habits of a number of people.

Poisoning from Shoe Dye

MUEHLBERGER in 1925 reported an exhaustive review of the literature, and 10 cases of his own, bringing the total then reported to 58 cases.* In his report, he quoted all the data and entered into an analysis of the cases. Up to the time of his report, all the cases had been due to nitrobenzene. In his series of 10 cases six were due to analine poisoning.

Patek in 1926 reported three cases, all of which were due to analine dye.

Cases have been reported by Forsberg, Aikman, Albert, Ullman, Kling, Ramond, Rodda, and many others.

The following symptoms may be summarized as characteristic of the poisons from the solvents used in shoe dyes:

Headache, dizziness, restlessness, backache, paralysis, convulsions, ringing in the ears, vomiting, dyspnea, weakness, nausea, methemoglobinemia. A constant never failing sign is the very intense cyanosis, or bluish black discoloration of the skin, mucous membranes and nails.

All authors seem to agree on one phase of this subject and that is that the poisoning is caused by absorption through the skin of a solvent used in the dye, and that while there is no specific treatment for the disease, washing the skin and particularly that of the feet, thoroughly with soap and water, seem to give good results. The giving of salines laxatives was also recommended.

The following four cases, seen or contacted during 1933, were reported by the author:

CASE 1. G. V., boy, aged 4. Past history negative except for occasional attack of sore throat, and history of rheumatic pains about three months prior to this attack.

Had gone fishing in the morning and was brought in in the afternoon because he was blue and complained of dizziness.

On examination the temperature was normal, pulse was fast and thready, he seemed nervous and there was a marked cyanosis of the mucous membrane and nails and a greyish discoloration of the skin. Cardiac stimulants, a warm bath and rest in bed were ordered. Recovery was uneventful, and all signs were absent after five days.

Later history developed the fact that he had worn a pair of open work oxfords which, on the previous day his father had dyed black.

CASE 2. J. C., boy, aged 10. Previous history negative.

Went to picture show in afternoon and came home feeling well but looking very blue.

On examination nothing was found except marked cyanosis, which lasted for three days. Bath and rest in bed ordered. Recovery was uneventful.

Had worn a pair of shoes dyed black 24 hours previous to attack.

CASE 3. J. G., boy, aged 13. History and physical findings were much the same as in preceding case, except that he fainted and was very dizzy.

Treatment, bath and bed rest; uneventful recovery, complete in five days.

Had worn shoes dyed black on previous day.

CASE 4. Reported by a colleague. R. B., girl, aged 10. Essentially same history as previous two cases, except that her pulse was rapid and temperature reached 100 F.

Treatment was bed rest. Signs of poisoning persisted for three days. Recovery was uneventful.

She had worn a pair of shoes dyed black on previous day.

These cases were apparently all of a mild nature, but serve to illustrate the point that in all

* DR. R. E. HARRY, in *The Nebraska State Medical Journal*, December, 1934.

cases of intense cyanosis, shoe-dye poisoning should not be overlooked.

Industrial Accident Neuroses

Suggestions for Appraisal and Treatment

By L. Cody Marsh, M.D.*

THERE is an increasing interest on the part of physicians caring for accident cases, in the psychiatric phases of industrial injury. But there is still a careless use of the word "neurotic" which in psychiatry is tantamount to the use of the expression "heart trouble" in general medicine. It is suggested first, therefore, that physicians use the nomenclature compiled by the National Conference on Nomenclature of Disease.

There are but three well-defined psychoses due to trauma: traumatic delirium, post-traumatic constitution, and post-traumatic mental enfeeblement. The physician is but rarely concerned with these, as the admission of patients suffering from traumatic psychoses is not more than .3%, according to May.

We are concerned here with the traumatic neuroses, and it is urged that we drop the nebulous expression "compensation neurosis" and be more specific, using also the classification adopted by the National Conference on Nomenclature of Diseases, for, after all, the traumatic neuroses are not essentially different from any others.

Hysteria:
- Anxiety hysteria.
- Conversion hysteria.
- Dissociation states (fugues, amnesia, somnambulism, catalepsy, trance, dual personality, etc.)
- Tics.
- Simple depression.
- Anxiety state.
- Neurasthenia.
- Hypochondriasis.
- Compulsive states: obsession; mania (kleptomania); phobias (agarphobia); tics; spasms.
- Mixed forms.
- Neuropathic personality: schizoid personality and syntonic personality.
- Maladjustment.
- Psychopathic personality.
- Constitutional inferiority.

It is quite possible that later we shall adopt a special classification for the traumatic neuroses, for these have certain things in common, especially the element of compensation. On the other hand, in many accident situations, such as those observed when the civil population is affected by the horrors of war, private dueling, personal injuries due to so-called acts of God—for example, earthquakes, storms, volcanic eruptions — injury due to athletic contests, in injuries in the home, and in injuries suffered in many other forms of employment not covered by accident insurance—for example farm work—we rarely see what we have understood as traumatic or compensation neurosis.

When there is no possibility of compensation, a neurosis does not ordinarily develop, even in the most neurotic types, as the psychiatric and mental hygiene situation is met promptly and spontaneously at the date of the injury.

Archambault, in his lectures to medical students at Albany Medical College, frequently remarked: "If I can get an industrial accident case while he is still a medical virgin and has not been contaminated either by legal counsel, a grasping relative, or great delay, I can return him to his job with a sound mind within a reasonable time, provided, of course, the surgeon succeeds with his task."

One thing brought out in this statement, to which attention has been called by others, is the "period of meditation." In other words, it takes time incident to delay, tardy settlement, uncertainty of outcome, and many other factors, for a patient to develop what we have vulgarly called a "compensation neurosis."

The writer believes that it is important, if the medical profession is to handle the neurotic factor with the same precision and effectiveness as are displayed in the surgical and medical procedures, to use a special type of anamnesis. This is necessary because traumatic neuroses represent a flight from reality, and, as such, they are purposeful, although the purpose may be conscious or unconscious. To make an appraisal then of a suspected neurotic factor in an industrial-accident case, it is necessary to have a great deal of special information.

I. Physical:

1. If the patient complains of pain, does a powerful analgesic relieve the pain? Conscious malingerers, as well as unconscious, will frequently complain that the pain persists, although they have received massive doses of anodyne.

2. What contribution does pre-existent pathology make toward the patient's complaints? A neurotic patient is very apt to show a cumulative state composed of aches and pains, signs and symptoms of previous ailments, of which he was aware or unaware, and combined with the signs and symptoms incident to the present injury.

3. How logically are the signs elicited in the physical examination connected with the present injury?

II. Psychiatric Analysis:

1. As a result of the usual and standard examination of the patient, what personality impression does he give, is he the sort of person who would be likely to develop a traumatic neurosis? Is he shut-in, unstable, rigid, schizoid, inferior, psychopathic?

2. Have there been any other physicians on the case? What have they done and said to the patient? And how much time has elapsed since the injury?

3. What is his general behavior during the examination, to active and passive movement, to pain? Is he irritated by the procedure? What comments does he make concerning the examination and the accident?

4. Has he engaged counsel?

5. Are his symptoms logically connected with his injury, and are they exaggerated?

6. What is his attitude toward returning to work?

7. If he limps or shows any other mechanical token of injury, does he do it well or too well?

8. What inconsistencies, if any, do you notice in the patient's behavior or comments?

9. Is the employer or the insurance carrier showing any delay or other attitude which might precipitate a neurosis during the meditative period?

*In *Southwestern Medicine*, December, 1934.

10. If you believe the patient is malingering, is this a conscious or an unconscious process?

11. Ascertain from the patient if he has been satisfied with his job, compensation, associates, superior officer, and working conditions. Replies in the negative might indicate a very appropriate foundation upon which a traumatic neurosis could be erected, and suggest prompt prophylactic mental hygiene.

12. Patient should be asked guardedly about his home conditions and personal happiness. If his home conditions are unhappy or if he expresses marked dissatisfaction about his personal life, another foundation is suggested upon which a neurosis might be developed.

III. Outside Information: No psychiatric anamnesis would be complete without information from persons other than the patient, whether they are neutral or biased. Information should be obtained from the patient's superior, from some member of the family and from some associate whose friendship is not unduly burdened with bias. Among other things, the following questions should be asked:

1. What has been the patient's job history in general? Has he been successful, well-thought-of by associates and employers, able to follow directions, punctual, skilled, industrious, trustworthy? Is he noted for cheerfulness, common sense, and good judgment, or has he been moody and inclined to shirk? What is his behavior when he gets hurt? How much time does he lose over minor injuries and illnesses?

2. The same information should be obtained about the present job with a special care. In addition, it should be asked if he was satisfied with his work and pay, and if he had any special grievances from which a neurosis might provide an escape.

3. How does the patient behave outside of the doctor's office? Does he show the same limp or other mechanical token of injury? Does he go on with his pleasure life or avoid it? How much does he make his family aware that he is suffering? In general, what is his behavior off guard?

4. What is his energy quotient outside of the doctor's office? Most patients suspected by their physician of malingering or of neurosis, show a very much depleted energy quotient in the presence of the physician and a markedly augmented energy quotient when safely away from the doctor's office. This may be conscious or unconscious.

5. In the case of a patient exhibiting facial expressions of pain while in the doctor's office, does he show this on the outside and how much?

6. What are the patient's home conditions and home influences? Is his wife or any other member of the family urging him, directly or indirectly, to exaggerate or feign symptoms in order to obtain increased or continued compensation? Is there anything in the patient's home life which might cause him to seek a means of escape by developing a neurosis as a result of injury?

IV. What Objects Could the Patient Gain by Means of a Traumatic Neurosis? Only in so far as we can gauge this accurately can we be of any real psychiatric assistance in helping the patient to recover from the neurotic element, since all neuroses are purposeful, whether conscious or unconscious. Because the neurosis represents, as it always does, bad judgment in the underlying purpose, it is futile to argue with the patient. He must be shown by a flank attack a more constructive means of escape and one which satisfies the criteria of good judgment. Therefore, is the neurosis as an escape mechanism helping the patient to escape an unpleasant job, a disagreeable associate, an intolerable boss, an offensive home personality, or any other inferiority situation?

Recommendations for Prophylaxis and Treatment

INDUSTRIAL: 1. Industry should pay more attention to the personality type of employees and keep away from danger those who show a tendency to get hurt, or because of their neurotic make-up, are inclined to take flight in neuroses.

2. Where employers have their own physicians with offices within the working establishment, care should be exercised when treating injured workers, to anticipate the possible development of neuroses, especially in personalities who would naturally lean to such an escape.

The writer recalls a fine-looking boy of 22, treated in a factory accident room for the loss of the distal phalanx of his index finger. He joked about the whole business and left laughing, only to attempt suicide within the next hour. He was a musician and was working in the factory to earn money for his continued education. Thus "laughing a thing off" is a risk type of mental hygiene and should not be used unless the doctor knows his man.

3. It is suggested that employers keep not only the standard job record on each employee, but also notes under the following headings:

(a). Ability to get along with people.
(b). Ability to follow directions.
(c). Ability to lead others.
(d). Type of moods shown while at work.
(e). Estimate of common sense and good judgment.
(f). Ideals of courtesy, honesty, and service.
(g). Initiative and resourcefulness.
(h). Mechanical skill.
(i). Orderliness, system, and neatness.
(j). Perseverance and industry.
(k). Physical strength and general health.
(l). Promptness and punctuality.
(m). Responsibility and trustworthiness.
(n). Time lost and for what causes.
(o). Behavior when sick or injured.
(p). As many traumatic neuroses are based upon deep feelings of resentment because the employee feels he has not been justly treated and that his talents have not been adequately marketed, it is suggested that where possible the worker's record card show the following facts and that such facts be recognized in practical ways: national origin, languages spoken, education, special training, usual occupational classifications, hobbies, pastimes, special abilities, tastes and talents, clubs and organizations, occupational interests and ambitions, religion, intelligence rating based principally upon industrial performance.
(q). All employees in industry, especially where the employer is liable in case of accident, should be required to submit to a physical examination and the results should be placed with the employee's record. Then in case of accident, physicians may more promptly and accurately estimate the bearing of the employee's previous condition upon the present accident situation.

4. It would be to the advantage of physician, employer, and insurance carrier, if more complete records were kept on employees, not only as to their job behavior, aptitudes, and progress, but also as to their personality makeups and the type of personality displayed in the job situation. Such information would be a valuable guide in the handling of those accident cases which are thought to have either a frank malingering factor or an unconscious neurotic element.

5. The employer should also exert himself promptly to assure the injured employee that he will be adequately cared for, and thus he need not engage counsel, but, on the contrary, avoid getting into the hands of unscrupulous attorneys. It would be well in the same connection to assure him that upon recovery he can return to work, and, if his accident has maimed him so that he cannot do precisely the same thing, that nevertheless another type of employment will be found for him.

6. Where industrial hazards are marked, there may be some value in the suggestion of offering bonuses to employees who have a low injury record.

II. THE INSURANCE CARRIER: It is urged upon insurance carriers that they modify their attitude in regard to the one injured and invalided by an industrial accident, in which they disapprove of his engaging in any gainful occupation while receiving compensation. It is the opinion of many of us in the field of psychiatry that this attitude is expensive to the insurance carriers and therefore tends indirectly to make the cost of industrial insurance higher than it might be. It is during these long periods of inactivity that so many patients develop neurotic symptoms which, in turn, prolong considerably the period of invalidism and, therefore, of compensation, which comes from the carrier's purse. In this connection, the writer offers two suggestions: one, that where possible the present employer give the patient an easier job approved by the physician. This keeps the patient under the emotional stimulation of his customary job habitat, and quite humanly, he is made anxious to gain favor and approbation among his fellows by getting back to his original and better position. The other suggestion is that, where the above is not possible, the patient be allowed to take any gainful occupation he may obtain by his own efforts or those of others. While this is not as valuable from a mental hygiene standpoint as the other suggestion, it is still valuable, and the patient ordinarily is too much entertained by occupation and the fact of even a small remuneration, to develop a neurotic condition.

It is suggested that the insurance carrier employ psychiatric social workers to obtain information and observations regarding the patient's home life and outside activities, where the physician believes such data will assist him in appraising a suspected neurotic factor or malingering. Too often investigators have not had appropriate technical training and experience for this delicate task. While the adoption of this suggestion entails added expense, the representative of one carrier told the writer it was his firm's belief that 30 to 50% of compensation paid was chargeable to the neurotic factor, and that at least half of the money paid to satisfy judgments in lawsuits was due to the neurotic element also.

It is highly important that the insurance carrier not only reduce red tape and make as prompt an adjudication and settlement as modern efficiency can command, but, what is still more important, that the carrier take pains to inform the injured at the outset that such will be the case. Often the protracted periods of waiting and doubt are malignant factors in precipitating in the patient's personality a neurosis which, in the long run, is very costly to the carrier.

In certain cases the insurance carrier would find it to its advantage to allow the attending physician to treat coexistent maladies.

Where it is believed that the patient is in danger of, or has already developed, a neurosis which threatens to make the case unduly costly, the carrier would do well to have the attending physician refer the case to a psychiatrist.

III. MEDICAL:

1. A physician should never openly and directly charge a patient with malingering or with being neurotic. This is a situation which should never be met directly, but with the cleverest indirection. Above all things, the patient's "face must be saved," whether the physician believes the patient is malingering or not.

2. It is most important that the patient's confidence be won and even unreasonable symptoms be listened to patiently and respectfully.

3. The patient should be assured of the best possible prognosis.

4. The physician should promptly offer to give what aid he can in obtaining a prompt settlement.

5. It is highly desirable that the physician, if possible, give within reason, treatments which the patient desires. This may seem unreasonable to many men and highly unscientific. However, it has great practical psychological value in dealing with the neurotic individual, especially if the intelligence quotient is low.

6. It is desirable, although insurance companies may not allow it, that the patient be treated for coexistent maladies. Such maladies, because of discomfort, pain, or inconvenience, may be largely responsible for the creation of the neurosis.

7. Even at the very first consultation between patient and physician, the latter should prescribe and insist upon some form of occupational therapy. The enforced idleness incident even to temporary deprivation of occupation is a very fruitful soil for the development of a neurosis. We can prescribe occupational therapy of many sorts, even though they are not gainful. It is desirable in this connection that someone report on the patient's job behavior in connection with the occupational therapy. Thus the physician may obtain knowledge which may enable him to forestall the development of a traumatic neurosis, either by a change of the occupational therapy or by an appropriate psychotherapy.

8. It is highly important that the physician at the very outset begin some sort of psychotherapy, or mental hygiene program, to run noncomittantly with the medical and surgical procedures. Among other things, it is important to keep alive or to cultivate what the writer calls "energy-releasing ideas," ideas relating to ambition, promotion, success, the culture of courage, the satisfaction of having been courageous in the present instance, building plans for future economic success, and so forth. In this connection, the physi-

cian should be conscientious in praising the patient for even the most trivial gains or tokens of cooperation and progress. The physician should go out of his way to conspire with the patient to find some sort of happiness during the period of invalidism.

9. A very practical and helpful procedure is for the physician or employer to arrange, when the patient may do so, excursions to his job location. This gives him encouragement and keeps up an interest for recovery and the return to his job.

10. The physician, having learned of other objects which the patient may entertain, consciously or unconsciously, in developing a neurosis, might give adroit suggestions as to how the patient may obtain these same objects in a more constructive and therefore a more satisfying fashion.

11. If it is believed that some "key relative" or other person is urging the patient to prolong invalidism by means of neurotic symptoms, it would be well that this individual be contacted and his cooperation secured toward a more constructive use of his influence.

12. It is highly important that patients be given adequate anodynes for pain, and hypnotic drugs, if necessary, so that they may have the benefit of comfort and adequate sleep. It is the writer's experience that there is still an aversion on the part of industrial surgeons, as well as practitioners who occasionally see industrial cases, to the giving of anodynes and hypnotics because of an unduly emphasized fear of habit formation.

Fixed Skeletal Traction

THE effectiveness of this method of traction has so outweighed the objections that have been raised that it enjoys almost unanimous popularity in fracture surgery. The advantages of skeletal traction might be briefly outlined as follows: *

1. It is direct, in that it is not dependent upon the soft tissue for its pull, as traction is made directly upon the fractured fragment.

2. There is better control of the fragments, as thereby it is possible to turn, rotate, or change the line of the pull at will.

3. It requires less weight to overcome over-riding, because of the directness and the positiveness of the traction.

4. The traction is constant and equal on both sides of the fragment.

5. It is more comfortable, in that there is no extensive skin irritation, or interference with circulation, such as often accompanies adhesive traction.

6. The results are far more satisfactory, in many instances, than can possibly be expected of ordinary skin traction.

7. When splints are used they can be so adapted that joints below, and perhaps above the fracture, may be mobilized, in part, during the period of treatment.

The chief objections to the method are:

1. Slipping, which sometimes occurs when "ice-tongs" are used.

2. Side-slip of the pin after a period of time.

3. That there is always a certain amount of soft tissue and bone necrosis about such apparatus which, after removal, is often slow to heal, and when placed near a joint causes periarticular changes of an arthritic or inflammatory character.

4. There is the possibility of infection at the point of bone exit and bone entrance of this foreign metal body.

The advent of the Kirschner stainless or chromium wire has to a great extent overcome and minimized these objections, with perhaps the exception of the possibility of infection.

Fixed skeletal traction by our technique is as follows: The patient is placed on a fracture table with the extremity in a position to advantageously apply the necessary traction and counter-traction for the reduction. The area in the extremity through which the wire is to be passed is prepared by painting with tincture of iodine or merthiolate. The essential steril drapings for strict asepsis are applied. Surgeon and nurses are prepared as though for a major surgical procedure. With a telescoping drill and guides the wire is passed through the proper bony portion of the extremity to accomplish the most adequate traction. Cotton collodion dressings at the entrance and exit of the wire are applied. The steel pressure base and taut bolt are slipped over the wire. The bow is then aplied and clamped on and the wire tuned up to proper tautness. Traction and manual reduction are then accomplished by the use of the fracture table apparatus. Soft, heavy felt is applied over the bony prominences, and at the extremities of the cast. Seldom is sheet-wadding used. Anterior-posterior splints of sufficient length are moulded to the parts to be encased, and brought firmly against the extremity with a three-inch crepe paper bandage. This is followed by reinforcement with circular plaster of Paris bandages. After the cast is completed the steel pressure plates are pushed firmly against the cast and the screws tightened to the wire just as close to the pressure plate as possible. No particular force is made, however, against the cast while it is soft. The patient is returned to bed and placed under a Balkan frame, merely to give the extremity the most advantageous resting position. Unless the casts are under hourly supervision they should be splint to prevent the possibility of constriction, and ischemia, tightnes and swelling. This, however, is seldom essential where adequate fracture supervision is maintained. Then after one or two days, when the cast is thoroughly dry and x-ray check-up shows that the fracture is in satisfactory position and alignment, the taut bolts are tightened firmly against the wire through the holding set screw in the head of the bolt, and the bolt nut is turned with a wrench until the tautness is released from the bow; then the bow is removed and the wire ends cut off during the remainder of treatment.

The advantages of this taut bolt are:

1. It is absolutely effective in maintaining the proper tune and tautness in the wire.

2. It is inexpensive to procure.

3. It does not have to be covered or held by plaster of Paris to make it effective.

4. It is possible, by this procedure, to allow a certain number of fractures of the extremities to be up and around and bearing weight much earlier than would otherwise be possible.

5. It is particularly adaptable when two wires are used, one above and one below the fracture, as in leg and arm fractures.

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*Dr. J. E. M. Thomson, in *The Nebraska State Medical Journal*, December, 1934.

Medical Departments

— Twin City Health Service* —

THE Twin City Lines in the street railway system of Minneapolis and St. Paul. The Health department of the company is organized under a General Director, who is also Social Service Director. There is a Medical Director, an Associate Medical Director, and "station physicians" who spend one hour daily at each of the six stations from which the men work. There are three nurses who work under the direction of the General Director and in close cooperation with the Medical Director and the other physicians. The nurses are at the executive office building for the first hour of the morning and at other times by appointment. The remainder of the day is spent in home visiting and other services in behalf of the employees and their families.

The health service is administered through an Employees' Mutual Benefit Association, which, in a general way, provides complete diagnosis and medical care for the employee at the medical office. It provides payment for surgery, and choice of surgeons. It takes care of $50 of the hospital bill, x-rays, special appliances, and dental extractions and x-rays. There are sick benefits for a maximum of 52 weeks for one disability and death benefits. It provides payment for three-fourths of the cost of surgery for a wife or child.

Membership in the benefit association for the five years was as follows: 1929—2,841; 1930—3,058; 1931—2,685; 1932—2,478; 1933—2,414. This reduction in membership follows a corresponding reduction of force due to the dead line being reached in use of street cars as a means of transportation . . . .

During the five-year period of 1929-1933 inclusive, sick benefits were paid on 158 diagnoses of illness or injuries . . . .

Our composite picture shows a sharp rise in degenerative diseases, a comparative level in the gastro-intestinal group; tuberculosis rising a little the last year; acute respiratory diseases dropping slightly, but always expensive to industry; nervous and mental diseases rather an even curve but from the standpoint of mental health, this very signifiicant factor—a definite increase in the average number of days per ilness and a definite increase in the average cost per case. Last year, the patient did not "snap out" of his illness with the same degree of decisiveness. Therein, it seems to me lies the most tangible expression of his reaction to the lmnts of dpression and insecurity . . .

The following are concrete and essential elements in an industrial mental health program:

1. Payments of sick benefits during illness. The knowledge that income will not cease does as much as any one thing I know of for peace of mind during illness.

2. Certainty of employment on recovery. Who can estimate what that has meant during these years when jobs have been so hard to get!

3. Social Service department where help and advice are readily available. Of paramount importance is the integrity of this department.

4. Medical service. Like the Social Service department, the integrity of the medical department is its outstanding attribute.

5. Nursing service. The nurses are available for problems of illness of members of the family as well as the employees themselves, and again years of association have formed bonds of sympathy and understanding so that the majority of the calls come from the patients directly and there is no hesitancy in seeking the services of the nurses.

6. Recreation rooms. At each station there are rooms with pool and billiard tables, card tables, chess and checker boards, a radio, a library of books and current magazines and a refreshment counter. These rooms are also used for station parties.

7. Rest rooms. These have cots where the men may rest.

8. Shower baths and barber shops.

9. Dining rooms in the shops, where one hot dish and beverage supplement the lunch brought by the employees.

10. "Sick bonus." These are hours of employment suited to the strength of the convalescent patient, and represent as fine an example as I know of, of cooperation between the management and the medical department. As it is used by the Medical Director, it has become a most valuable therapeutic measure in promoting complete recovery.

11. Retirement pension.

12. Group insurance with permanent disability clause.

* From an Article by Heide Henriksen, R.N., in *Public Health Nursing*, June 1934.

Urinary Silica

AS A PART of the survey of the effects of the inhalation of dust in the anthracite coal industry, Bloomfield, Sayers, and Goldman* undertook a brief study relative to the possible recovery of excessive amounts of silica in the urine of mine workers in which silica dust exposure had been previously established quantitatively — it being believed that recovery of excessive amounts of silica in the urine would furnish further proof of the abnormal intake of silica dust.

Previous work by King had demonstrated that the urinary excretion of silica is at a higher level in persons exposed to silica dust than in normal individuals.

In the instance of the anthracite workers, these men were subject to the inhalation of dust varying in quartz content from 4 to 43%. Accordingly urine specimens were collected at the mines and were immediately analyzed for silica by the method described by King and Dolan. The results showed that the silica content varied in milligrams per 100 c.c. from 0.6 to 11.7, averaging 2.5. Control samples showed an average silica content of 1.0 milligram per 100 c.c.

The authors also believed that a definite correlation could be shown between the amount of silica dust inhaled over a period of years and the urinary silica found in the samples. The actual mathematical correlation was 0.48 and the probable error 0.04. Attention is especially called to the fact that no person with an exposure to more than 2,000 million silica dust particles-years was excreting less than the amount of silica found in normal persons, and that 64% of the persons with an exposure of less than 500 million silica particles-years were excreting urinary silica in amounts less than

*Bloomfield, J. J., Sayers, R. R., M.D., and Goldman, F. H.: *U. S. Public Health Reports*, V. 50 No. 13, March 29, 1935.

2.0 mgms. per 100 c.c. Included also was a survey of a small group of former mine workers having an average exposure to anthracite coal dust for 37 years, but who had been out of industry an average of seven years; in these instances the average of urinary silica was 2.1 milligrams per 100 c.c. and was greater than the amounts found in non-miners at the same institution. This finding was also in agreement with former work of King and Dolan, who obtained corresponding data on a group of six gold miners not exposed to dust at the time of the examination. Other workers who had been free from dust exposure for less than five years were found to be excreting slightly more silica than those who had been away from the industry for a longer period.

As the authors state: "The present brief inquiry does not furnish sufficient data to determine the value of the urinary silica examination as an aid in the diagnosis of anthraco-silicosis. Excessive silica excretion probably merely indicates an abnormal intake of silica. It does, however, furnish additional evidence of the etiology of the disease."

In these statements, we can see additional emphasis placed on the etiology of silicosis; perhaps as a diagnostic procedure, we shall have to wait further research relative to more accurate knowledge concerning the metabolism of free silica.

Electric Welding Hazard

FOR many years industrialists and physicians have more or less speculated upon the effects caused by exposure to the particulate fumes developed by the use of electric welding apparatus. About eight years ago Drinker and others worked out the threshold doses of zinc oxide, and other authors showed that various metallic oxides could cause what is known as metal fume fever. It was also established that this metal fume fever does no lasting harm, the effects are not cumulative, and the substances which cause the fever, such as zinc and magnesium oxides, are not true industrial poisons.

Recently Titus, Warren, and Drinker* have demonstrated that the injurious effects in animals exposed to the air in which electric welding was being done on various metals, were not due to the metal fume itself but rather to the gases generated by the arc, which are probably in this instance nitrogen peroxide and ozone.

In this series of experiments, ferric oxide and aluminum oxide were used, because both of these oxides can be made easily in the electric arc and, for control purposes are available as powder.

Steel was welded or cut electrically in a 1600 cu. ft. gas cabinet in which cats and rabbits were exposed. In order to increase respiration, carbon dioxide was added to the air in the cabinet in varying amounts from 1% to 14%. Exposures were varied from 58 to 510 minutes in concentrations of ferric oxide fume averaging from 35 to 250 mgs. per cubic meter.

For control purposes, some animals were placed outside the welding room in a special container through which filtered air from the welding room was passed during the experiments; the filter removed the fume particles very effectively and possibly some of the gases by reaction with the filter or by absorption (since ferric oxide is notably absorptive). However, the results show that the removal of the solid fume particles did not eliminate the toxic properties of the gases generated in the process.

Another method of control was the blowing of chemically pure ferric oxide (red powder) into cabinets where no welding was done, the animals merely breathing the oxide powder. In such instances the animals exposed with no welding going on showed no effects whatever.

Finally, results showed that animals which were exposed to the air where welding was done and also to filtered air frequently developed fatal or severe pulmonary edema, occasionally accompanied by lung hemorrhages. The cause of the pulmonary edema could not be assigned to the iron oxide fume particles, but probably was initiated by exposure to the gases generated by the arc, as before mentioned, probably nitrogen peroxide and ozone.

In the same publication referred to in the footnote, Dr. Frank L. Williman reported a case of acute fatal pneumonia following electric welding of galvanized iron in a confined space. A complete history was obtained in this case, accompanied by roentgenological and other clinical examinations. Pathological findings in this case showed that the lungs were large, well dilated, the cut surface bright red and with large amounts of foamy serous fluid being exuded. It is the belief of Dr. Williman that the man died as the result of repeated exposure to the nitrous gases generated by the electric arc and the recommendation was made that such work places should be properly ventilated.

Regarding the prevention of the respiratory hazard during electric welding, Drinker, Warren, and Page recommended that excessive metal fume and gas inhalation be avoided by one of the following methods: (1) general ventilation of the work place; (2) local exhaust ventilation discharging fume and gas outside the work place; (3) use of respirators containing adequate filters and gas-absorbing cartridges or canisters; and (4) the use of air masks.

In considering these problems, many persons have in the past confused fumes which are solid particles with gases which contain no particulate matter. It may be that this confusion has resulted in placing the emphasis upon the particulate matter generated rather than the gases, which apparently from these recent researches are the real cause of serious trouble.

*Titus, A. C., Warren, Henry, and Drinker, Philip: "Electric Welding. I. The Respiratory Hazard." *J. Indust. Hyg.*, 17, July, 1935.

Psychology of Free Choice

PSYCHOTHERAPY* presupposes a sentient and selective relationship toward the source of the healing force; namely the physician. I should like briefly to refer here, even at the risk of digression, to the fact that this very psychologic principle, namely, that the patient must have freedom of choice in the selection of his physician, is the most serious objection to the socialization of medicine. The experience of large organizations, civic, industrial, military and

* From a paper entitled, "Psychiatry in General Practice, With Special Reference to Therapy," by Menas S. Gregory, M.D., read before the Medical Society of the County of New York, April 22, 1935, and published in *J.A.M.A.*, July 20, 1935.

otherwise, that provide medical care for their members, has amply demonstrated this fact. Such organizations although, as a rule, very well equipped, have failed to render satisfactory medical care commensurate with their effort and investment. The directors of the medical services of municipal police, fire and sanitation departments and many similar organizations readily admit that the sick members of such groups always prefer to be treated by physicians outside of the organizations. In other words, they would rather be treated by physicians of their own selection. During the late war, although the army had well organized medical units in the various military camps, there was a definite tendency on the part of the soldiers to seek medical aid from physicians in the neighboring villages and towns.

I think one is justified in asserting that socialized medicine would endanger public health by depriving the individual of one of the basic and most effective factors of therapy.

Treatment of Burns

WITH the ever-increasing problems of burns due to automobile accidents, it seems timely to reiterate a basic physiologic principle in their treatment.* First advocated and experimentally shown by the late Underhill and his co-workers, the successful treatment of extensive burns in the first stages depended upon the correction of blood changes resulting from its concentration. The anhydremia, which may reach as much as 70% of the blood volume, with its lowered blood chloride, they found was due to an acute increased capillary permeability.

Case 1. H. T., white, 40 years old, admitted per stretcher. Areas burned included the whole head extending over neck as well as both hands. First and second degree burns. Fluids: 1000 c.c. N. saline by hypodermoclysis, 2600 c.c. N. saline plus 5% glucose intravenously, 1000 c.c. N. saline proctoclysis, 3000 c.c. water by mouth. Total 7600 c.c. fluid in first 18 hours. 1600 c.c. water by mouth the second night. Treatment of burns in order used: Butesin picrate, boric acid 3%, bismuth ointment, dichloramine-T, Dakin's solution, chlorozine, mercurochrome, and normal salt solution. Continually asking for water. Fluid given within one hour of admission. Lived.

Case 2. K. B., white, 27 years old. Walked into the hospital. Areas burned: head and neck, both hands and wrists. Left leg, and right thigh. First and second degree burns. Fluids: 1000 c.c. N. saline subcutaneously, 2000 c.c. N. saline plus 5% glucose intravenously, 1000 c.c. N. saline by proctoclysis, 3000 c.c. water by mouth. Total 7000 c.c. fluid in first 18 hours. Treatment: Butesin picrate, tannic acid, picric acid 2%, exposure to air, picric ointment, boric acid, bismuth ointment, and dichloramine-T. Continually asking for water. Fluids administered within one hour of admission. Lived.

Case 3. A. T., colored, 62 years of age. Admitted per stretcher. Areas burned: face, arms, buttocks, left leg. First degree burns. Fluids: 1000 c.c. N. saline subcutaneously, 990 c.c. water by mouth first 10 hours. Total 1990 c.c. in first 10 hours. Treatment: Unguentine. Miscellaneous: fluids begun 3½ hours after admission. Patient was unable to take fluids by mouth 10 hours after admission and nothing given after that except medication of caffeine and digifolin. Died 23 hours after admission.

Case 4. C. C., colored, 40 years old. Walked into the hospital. Areas burned: back, arms, hands, left leg, first degree burns. Fluids: 1000 c.c. N. saline subcutaneously, 1620 c.c. water by mouth in first 17 hours. Total 2600 c.c. fluid in first 17 hours. Treatment: Unguentine. Miscellaneous: fluids begun eight hours, 45 minutes after admission. Died within 36 hours.

Underhill's experience stresses the importance of enough fluid to restore the patient's former blood concentration. Quantities varying from four to eight liters have been generally sufficient. It will be seen in the first two cases that fluids were pushed immediately, the immediacy being just as important as the amount of fluid given. Both of these factors are in striking contrast with Cases 3 and 4. Fluids in the form of normal saline when given other than by mouth should be given for the loss of blood chlorides. The blood contraction due to the exudation through highly permeable capillaries into edematous areas should be vigorously corrected by means of water by mouth. With the minimum volume of fluid necessary to induce water intoxication approximating 35 liters according to Underhill, fear of producing untoward effects can be dispelled in the ordinary heroic amounts given.

Time Limit In Compensation

AS MATTERS stand now*, one may well ask such questions as: What, precisely, does the compensation law of New York State wish us to understand when it uses the term "lead poisoning?" What meaning, precisely, does it wish to convey by the term "contract?" Does one "contract lead poisoning" when one begins to accumulate lead in the system? Does one begin to have symptoms suggestive (though not necessarily diagnostic) of this disease even in the absence of disability? Does one "contract lead poisoning" only when one becomes disabled owing to an accumulation of the lead in the body? With the phraseology of the law what it is, definitions of these terms would be helpful. There would seem to be no conceivable justification for the facts that every time a case of this type comes up the whole subject has to be thrashed out all over again with considerable expenditure of time and money, and that this procedure should be permitted to continue until some indefinite time in the future, when as a result of successive court decisions, satisfactory, or possibly unsatisfactory, legal procedents shall have been laboriously established. The equitable administration of the compensation law not only in lead cases but also in occupational diseases generally is tied up irrevocably with some final decision on these important questions. Medical controversies can then be relegated forever to the realms of academic and theoretical discussion.

It is quite probable that the framers of the compensation law of New York State, when considering the question of time limitation in rela-

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* Dr. Charles, *Ky. Med. J.*, Dec., 1933.

* Dr. C. M. Hamilton, in *Journ. Tenn. State Med. Assn.*, Dec., 1933.

tion to industrial disease, had no conception of the difficulties which would result from their use of the term "contract." They were probably entirely unaware of the fact that an industrial disease might very legitimately be "contracted" in a medical sense more than a year prior to the onset of disability. It has been seen, however, how unfortunately the New York phraseology with reference to time limitation has worked out in practice; that it serves no useful purpose, and that much better results have been achieved in this direction by Great Britain and the states which have followed her lead in this respect.

Dermatitis

THE cause of dermatitis* may be very difficult to demonstrate on account of the great number of irritants to which the skin is exposed. Most of the irritants are chemical. However, over a hundred plants in this country will cause a skin reaction. The most common are poison ivy and poison oak. They produce a more severe dermatitis than other plants as a rule. It develops rapidly and runs an acute course. The average duration is about three weeks. The eruption is usually vesicular and weeping. The blisters often present a linear arrangement such as may be caused by a brushing stroke across the skin. Many flowers will cause a cutaneous reaction. Primrose is one of the chief offenders.

A large percentage of cases of dermatitis of the face and neck originate from hair dyes and cosmetics. Dyes in furs may cause an eruption on the neck and face. The hair should be examined in all cases with involvement of the face and neck. This is especially important in middle-aged people whose hair is likely to be losing its color. The eyelids are particularly prone to be irritated from hair dyes and hair lotions. A dermatitis on the face from hair dye may be extended to the trunk. Toilet water and powders can cause a mild reaction in some people. Orris root is present in most cosmetics and is the cause of most of the trouble. Cosmetics known as non-allergic powder and cream are on the market and should be recommended to individuals with eruptions on face and neck.

Dermatitis of the periorbital regions may be due to the use of eyedrops containing butyn, atropine or dionin. Intranasal sprays containing butyn frequently induce a reaction of the skin of the upper lip and nose. Butesinephedrine is one of the offenders.

Dermatitis of the hands is frequently the result of contacts in occupation. Filling station employees react to gasoline and oils. Workers with glue and paste are subject to irritation. Printers and photographers are often annoyed by this condition. Dentists and physicians who use a great deal of novocain with ungloved hands may suffer from dermatitis.

Artificial dermatitis may be induced by carrying matches in pockets adjacent to the skin. This is more likely to occur in warm weather when the pockets become saturated with perspiration. In case of local dermatitis in regions of vest and pants pockets, it is well to investigate for matches or other chemicals.

Dermatitis may result from the application of strong drugs. It is sometimes caused by using two or more drugs that give rise to a chemical reaction that is irritating. Sulphur and mercury combine to form sulphide of mercury which is very irritating. Iodine and mercury also give a reaction by the formation of the iodide of mercury. Strong preparations such as ammoniated mercury are more apt to cause a dermatitis when confined by a dressing. They are also more prone to do harm when used on approximating surfaces. Ichthyol ointment is sometimes harmful. Dichloramine T., lysol, and other solutions commonly used in surgical dressings, frequently cause a dermatitis. Adhesive tape is often injurious.

The treatment of dermatitis is two-fold. Ascertaining and removing the exciting cause are factors of prime importance. Local treatment is also very essential. The difficulty of ascertaining the cause can hardly be overemphasized. The verification can often be made by means of the patch test. This consists of the simple application of suspected substances to the skin.

Desensitization therapy has been rather unsuccessful. The main measures are local remedies. The remedial agents should be protective in nature. Mild, soothing preparations are the most suitable. Gloves may prevent a dermatitis in selected cases. Housewives can use thin cotton gloves in doing the household duties. The cotton gloves absorb perspiration and prevent maceration of the skin

Wet dressings give better results in weeping vesicular eruptions than salves or powders. Salves will not adhere to wet surfaces very well and often cause a filthy maceration of tissues. Powders cause the formation of crusts which harbor infection. The choice of wet dressings varies to suit individual tastes. Saturated solution of boric acid is very satisfactory. Weak solutions of aluminum acetate, potassium permanganate or magnesium sulphate give good results. Phenolized olive oil is beneficial in the dry scaly stages. Boric acid ointment is often helpful. Calamine lotion relieves itching and is somewhat protective in the acute erythematous stage. Cooling creams and moist dressings are soothing to the erythematous eruptions. Lotions containing glycerine and alcohol are likely to irritate erythematous lesions. In the more chronic stages, ointments or lotions containing salicylic acid, resorcin, or tar may prove of benefit. Additional x-ray therapy in stimulating doses is worth applying.

Dermatitis is very prevalent on account of the enormous amount of chemicals that are being used in so many occupations. Its incidence ranks second in the list of skin diseases.

In this section ringworm is the more prevalent. Before prescribing strong irritating preparations, the character of the eruption, its location and the texture of the skin should receive careful consideration. The scalp will withstand stronger solutions than other parts of the body. Oily, thick pigmented skin is more resistant than dry thin translucent integument. Sulphur ointment should not be used over two or three nights a week in the treatment of scabies. In treatment, keep in mind that the skin has already been damaged by irritating substances and that protective measures are indicated.

* Dr. May R. Mayers, in *J. Indus. Hyg.*, Nov., 1933.

Industrial Medicine

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Opportunity

THE accountants view it as a moot point, but the financial powers are beginning to sense its reality.

"It" is the proposition that:

In any going concern the fact of the existence of a competent working force is a capital asset.

Analyze it: The executives will go home tonight without a thought as to the possibility that their plant might not open up tomorrow morning. Such a possibility is as remote from any consciousness as that there might not be a tomorrow. It is completely taken for granted that the routine will be resumed; eight o'clock will find every employee at his bench, or desk, or machine, ready to begin his accustomed duties.

But imagine the opposite: that no one were to come to work, that the whole personnel were to be wiped out.

How much would it cost to replace them so that the plant could begin again and continue as before?

Obviously it would cost a lot of money. Selecting, hiring, placing, training would involve direct expense. Time lost in getting adjusted, time and materials spent in making mistakes, accidents and injuries from the hazards of slow adaptation to new environment, all would involve indirect expense.

And with the plant in operation again there would be a sizable dent in the corporate surplus, and, regardless of whether or not the outlay were charged to operating expense, a sizable investment in personnel—$100 "per new man hired,"[1] would be only part of it.

This single imaginary situation differs from the thousands of real situations in industry only in the matter of elapsed time. The imaginary assembling of personnel would be done in a hurry; the real working forces were slowly gathered together, carefully built up. The investment exists in both.

THIS investment obviously is very real, quite as real as that in buildings and equipment. But the asset of a competent personnel, with its human qualities, is not static, not obviously tangible, not readily measured, appraised or inventoried—which, no doubt, is the basis of the accountants' reluctance to find a place for it on the balance sheet, a line of its own separate from the recognized "goodwill."

But, although the personnel asset is not recognized as measurably tangible, yet it is tangible enough to require maintenance.

The elements of its maintenance include workmen's compensation, safety measures as to accident prevention, preventive measures as to occupational diseases, health services, medical departments, vacations, pensions, sickness benefits, the so-called welfare policies, and other policies additional to the wage or salary consideration of the contract of employment—all of these things being directed toward keeping the employees at their highest point of productive capacity for the maximum amount of the working time for which they are paid. These are, as it were, operations *en masse*.

The cost of this kind of maintenance is a large part of the "indirect cost of labor." In the aggregate it is heavy; already its percentage relation to payroll is so large as to inspire a wide interest in how it can be reduced.

WE CAN think of two ways of reducing it, and both require the spending of more money—but in the right places.

First, however, where does the cost of these maintenance measures really lie? The largest part of the cost is well hidden. It is not in the expense of the maintenance services themselves, but in the conditions which make those services necessary: in the continual investments in employees who do not stay long enough to justify the expense of getting them used to their jobs, or, if they do stay, manage in one way or another to cost their employer more than their per capita share of the total investment he has to make to keep his force at an effective working point. It is thus not so much in the aggregate operation, as in the individual contribution to the need for the aggregate operation.

One way to reduce these indirect costs, therefore, begins with the employee before he is hired. It selects him, by examination. It brings to bear upon his examination every resource of medical science—so as to reduce to the minimum the probability that he will turn out to be one of those prone-to-accident, susceptible-to-disease, inclined-to-neurosis, favorable-to-absenteeism individuals whose pay, in one form or another, goes on while his work is being done by someone else.

The other way continues with the employee after he is on the payroll. It follows him up, examines him periodically, watches him for incipient disabilities and developing tendencies, and checks up on his condition, and his work, frequently enough to keep ahead of preventable physical and emotional flare-ups that will impair his usefulness.

[1] See "The Doctor and the Cost of Hiring," p. 351 herein.

THIS sounds theoretical and visionary. But that depends on the point of view. The fact is that it has been tried out in a number of employment situations and has fully proved its numerous values to the employees and its economy to their employers. The latter was made very apparent during the late depression, in several instances where a reduction in medical department facilities was followed by a sizable increase in the *a* element of the $A + a$ number of employees.[2]

The cost in added payroll was several times the amount by which the medical service appropriation was reduced.

On this basis, more money for medical departments means less expense for the many elements of the indirect costs of labor which the industrial physician can reduce. Statistics in this respect are meagre right now, but they are in the making. The inquiry "The Doctor and the Cost of Hiring" (p. 351) is intended to develop such actual proof as exists.

The outlook even in the early stages of this inquiry is that the present situation in industry will yield about 10 to one in dollars saved by more medicine as against dollars saved (sic) by less.

BUT the impressive feature of any thought along this line is the opportunity of the industrial physician. Not any industrial physician, but *the industrial* physician. For *the industrial* physician will understand the *economics* of his work. This understanding will be two-fold. It will grasp the employer economics: the mass economics of prevention, hygiene, sanitation, control of hazards, working conditions in general—and in this respect will have the somewhat abstract point of view of the public health specialist. It will also grasp the employee economics: the individual, inarticulate, often uneducated, and sometimes unintelligent effort—under the spur usually of necessity, and with the handicaps of physical conditions and temperamental idiosyncrasies—to find a place in the productive life of the nation; and in this respect it will have the intimate and personal point of view of the family doctor. Thus it will comprehend both the individual *and* his setting; it will consider the "human being not only as a biologic whole but also in his relationship to his environment." When he is sick, it will get him well again, not wholly as a matter of clinical service, but partly as a matter of restoring him to his working status. When he is well, it will help him to such adjustment to his environment as will continuously sustain his employer's investment in him, and his own very important investment in himself.

INDUSTRY, more easily than any other agency, can command the facilities for the full use of all the resources of medical science. And industry, without any doubt, wants those facilities. But it must be the industrial physician who uses them. And being the industrial physician who uses them is not simply being a physician with the ready-made list of patients comprised in the payroll; it is that *plus* the appreciation that each employee is, by very virtue of his being an employee, an individual economic entity, to be *made well* as a physical matter, and to be *kept well* as a matter of his economic place (1) as a unit of productive responsibility on his own and his dependents' account, and (2) as a unit of productive capacity in which his employer has an actual, and tangible, investment.

There is a flash of this whole situation in the "letter of referral" which Dr. Hutton mentions in his article on "Endocrinology and Industrial Medicine" (p. 357). This illuminates and Dr. Kessler's "Determination of the Capacity to Work" (p. 345) enlightens the opportunity of the *industrial* physician to the extent of revealing it as almost awe-inspiring.

2. See "The Doctor and the Cost of Hiring," p. 351 herein.

Liaison Indicated

TRUE," says *American Journal of Public Health*, editorially, "during this period (the last 25 years) much progress has been made in discoveries in this field (industrial health) and much has been written, but far, far too little has ever been applied. Deaf ears have largely been the recipients." (See p. 374 herein).

Maybe so. But isn't it more probable that the trouble has been not so much deaf ears as the wrong ears? For example, Dr. Allen D. Lazenby, of Baltimore, "presented," last month, a paper on "Pre-Employment Examinations." (See p. 385 herein.)

This paper was remarkably interesting in itself, and it got pretty close to the really fundamental matter of the actual cash value of such examinations to the employer—so close that if it had been presented at a meeting of employer presidents it might easily have started something. But it wasn't presented at a meeting of employer presidents; through no fault of Dr. Lazenby's it was read to interested ears as to its merits, but the wrong ears as to any effective new applications of the principles it touched upon. And that seems to have been the case with practically all the rest of the more important presentations of the *industrial* values of industrial medical subjects in times past—the doctors, in most instances, have been talking to each other and thus, as it were, to themselves.

If the combined essence of the many excellent studies of recent years concerning the values of physical examinations, pre-employment and periodic — of which Dr. Lazenby's, Dr. Michael Lake's,[1] Dr. L. D. Bristol's,[2] Dr. Hart Fisher's and Dr. C. O. Sappington's are typical—were to be forcibly, and statistically, and repeatedly, presented at meetings of executive associations, the United States Chamber of Commerce, for example, or the American Management Association, it would reach the *right* ears.

And, as to the practical significance of its message, these ears would be neither deaf nor "long and furry."

And why not such a presentation? It is just as good ethics to urge upon industry the soundness of the economics of more industrial medicine as to urge upon politics the unsoundness of the economics of more political medicine; just as proper to assert the advantages of the one as to defend against the disadvantages of the other. If physical examinations, in their true expression as

1. Value of Physical Examinations, DR. MICHAEL LAKE, *Industrial Medicine*, April, 1935, p. 204.
2. Pre-employment Physical Examinations, DR. LEVERETT D. BRISTOL, *Industrial Medicine*, April, 1935, p. 199.

briefly outlined by Dr. Lazenby, were universal in industry[3] there would be very much less ground for complaint as to the lack of medical facilities available to the general population.

The silicosis situation is an expensive lesson to industry. There are a good many among the executives of the companies to which it was most expensive who will always believe that the medical profession could have helped much more than it did to bring reason and common sense into the situation in time to head off a lot of trouble. It is true that the doctors knew, several decades ago, what was likely to happen; but when they talked about it, they were talking to each other!

A liaison medium between industry and the medical profession is indicated. Might it not be a committee selected jointly by the governing boards of the four associations of industrial physicians and surgeons[4] and the American Public Health Association?

A Claims Man Wonders

AS STATED elsewhere in these pages, *Industrial Medicine* is published "to promote sound thought upon and concerning industrial medicine. . . . The editorial policy is to encourage frank discussion." It can be taken for granted, therefore, that such communications as the "Reply to 'Industry's Sacred Bull'" which follows this, will be accorded space in its columns.

The Engineering Division of the St. Louis Safety Council takes rather seriously Dr. Lautenschlager's criticism of the "no-lost-time" accident record as it often—in his opinion, too often—is found in industry.[1] Among the interesting points raised in reply is the logic of the relationship to which the Doctor objects—wherein the "Safety Department is considered closer to the executive personnel than the Medical Department," so that "as a rule the Medical Department operates at the beck and call of the safety supervisor." In support of this the Engineering Division says: "Anyone not prejudiced will agree that a greater human service is rendered by the *prevention* of an accident than in caring for the victim after the accident occurs." This, of course, is so obvious that it will not be argued with. But—there are *two* buts—in the first place it is impossible in reading this reply to get away from the impression that the safety engineers' idea of the scope of the work of the industrial doctor is that "caring for the victim after the accident occurs" is all he does. This is unfortunate for the "cooperative relationship between the Medical and the Safety departments" which the reply bespeaks. And, in the second place, although "accident prevention programs are executed so capably and thoroughly . . . still the losses continue, apparently unchecked."[2] The necessary cooperative relationship will be greatly enhanced by recognition of the fact, now so thoroughly demonstrated to management, that the industrial safety situation needs much more than safety programs, and that what it needs is something that only the industrial doctor can supply.

Dr. Lazenby says very pointedly of one phase of the doctor's contribution, the pre-employment examination: "As a preventive of accidents and of occupational disease, I can think of no more crying need today in the general situation that confronts us."

Getting back, however, to "Industry's Sacred Bull," the safety enginers have done and are doing a marvelous work—such, indeed, as to make an argument about methods of getting up accident records assume rather minor importance. But all such arguments are helpful; they prove that men are thinking.

Undoubtedly in the present little argument neither side, as it were, is entirely wrong; each will find its advocates, with opinions, and its reinforcers, with facts. Thus Dr. Lautenschlager will be interested in the following from an address by J. C. Root, Chief Claims Examiner, North Carolina Industrial Commission[3]: "I wonder if in the enthusiasm for the prevention of accidents, the immediate treatment of injuries has not been too much neglected. And I wonder if either the management or those who are injured are altogether blameless. I fear that the zeal for a 'no-accident' record, and the hope of a new 'low' medical cost sometimes induce employers not to promptly report all minor injuries."

Reply to Dr. Lautenschlager

To the Editors:

PUBLICATION of an article entitled "Industry's Sacred Bull," by Thurman H. Lautenschlager, M.D., LL.B., in the January, 1935, issue of *Industrial Medicine*, was the source of considerable discussion and serious consideration by the Engineering Division of the St. Louis Safety Council at several of its monthly meetings, and by a Committee appointed especially to consider the article and to prepare a statement in reply.

—P. A. Lovely,
Chairman, Engineering Division.
July 18, 1935.

Statement in Reply to "Industry's Sacred Bull"

By the Engineering Division
St. Louis Safety Council

THE Engineering Division of the St. Louis Safety Council has given considerable thought and has devoted much time to a discusion of Dr. Lautenschlager's article, and believes that the importance of several questions raised by the Doctor requires a reply which will present the entire picture and probably enlighten your readers on one point at least, that of recording lost time accidents.

Referring to lost time accidents, none of our members, under any circumstances, within their combined years of experiences is able to recall that the method outlined by Dr. Lautenschlager, for the reporting of lost time accidents has ever been in general use. The Doctor has given the impression that the waiting period provided by state compensation laws is a grace period during

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1. See the definition of "industry," in "The Doctor and the Cost of Hiring," p. 351 herein.
2. The American Association of Industrial Physicians and Surgeons; The Association for the Advancement of Industrial Medicine and Surgery; the Central States Society of Industrial Medicine and Surgery; and the New York State Society of Industrial Medicine.
3. "Industry's Sacred Bull," Dr. Thurman H. Lautenschlager, *Industrial Medicine*, January, 1935, p. 15.
4. "Pre-Employment Examinations," Dr. Allen D. Lazenby, p. 385.

3. "Infection Prevention," J. C. Root, p. 386 herein.

which the days lost, as a result of an injury, are not counted. With very few exceptions, there is no relation between the waiting period before compensation begins and the waiting period before lost time is counted. The National Safety Council, the Affiliated Community Councils, the United States Bureau of Mines and practically all industry, adhere to a standard definition of a lost time accident as follows: "an accident wherein a man is so seriously injured as to be unable to return to his work on the next regular shift." Nothing could be clearer than this definition, it is generally accepted, and has nothing to do with the waiting period under the state compensation laws.

The Doctor complains that the Safety Department is "closer" to the management than the Medical Department. To quote the Doctor: "Although unfortunate, it is true that the Safety Department is considered closer to the executive personnel than the Medical Department. Thus as a rule, the Medical Department operates at the beck and call of the safety supervisor. The contrary should be the proper arrangement; the Safety Department should be under the Medical Director." The Doctor laments the fact that "The laymen enjoy a superiority over a professional status. Therefore, the Safety Department dictates the policy as to the classification of a lost time accident."

It is logical that this relationship should exist. Anyone not prejudiced will agree that a greater human service is rendered by the prevention of an accident than in caring for the victim after the accident occurs. "An ounce of prevention is worth a pound of cure."

In any organization or industrial plant, one department provides work for other departments in the ordinary line of its production, sales and shipping, etc. Each department is a unit, but definitely related to every department. Confusion and inefficiency would result if this scheme were not adhered to. Spoiled products make work for the junk man and waste-pile. Broken machinery makes work for the maintenance department, and the failure of the Safety Department to prevent accidents provides work for the Medical Department.

There is no apparent reason why the scheme of organization should be abandoned when a professional man enters the picture. Physicians are expected to function within the limits of providing medical care, and if there are physicians who resent these limitations, who cannot work as a part of the organization, then it would be advisable for them to avoid industrial practice.

In like manner, Safety Departments should not reach over into the medical field. Any treatment of an accident victim by the Safety Department should be limited to first aid.

It was the general opinion expressed during our various discussions that very few physicians had any conception of the plant operations, of the type of work the men were doing, or the nature of work they were best fitted to do. It was also agreed that, in too many instances, the Doctor was inclined to listen too much to the employee who has been injured or who claimed injury, who, unfortunately in many cases, is a malingerer.

The safety man or personnel man through his daily contact with the employees, is in better position to understand the temperament of the employees than is the doctor who only meets them when he treats them for an injury. This point is made to bring out the fact that it is generally felt by the safety man that the doctor and himself have many things in common in determining the seriousness of the injury. At the same time it is believed that in too many cases industrial physician fails to distinguish the difference between the treatment of the industrial employee and his private patients. The safety man or the personnel man knows the nature of every employee, should know what he is best fitted to do, and can tell fairly accurately when a man is feigning.

No Safety Department should attempt to dictate to the Medical Department or to an ethical physician. The word of the Medical Department should be law for so far as the injury is concerned. If the injury incapacitates the worker, no matter how minor the injury might be, the patient should be left entirely in the hands of the physician. If there is no general incapacity with no serious effects, then the patient should be returned to the Safety Department for placement in work, approved by the physician. This routine on the face of it is predicated upon an unprejudiced *cooperation* between the Medical Department and the Safety Department.

The physician does not go around telling about the number of cases he has successfully treated. To do so would be considered unethical. It would also be extremely immodest, because the physician alone is responsible for his good work. In addition, publicizing his success would be of no benefit whatever in reducing illness or accidents in the future.

This same reasoning applies to industrial accidents.

On the other hand, the Safety Department can, with all modesty, talk endlessly about the safety record of its organization, because it is the workers who make the record and not the Safety Department.

And, furthermore, publicizing a good safety record, keeps the workmen safety conscious, keeps them interested in themselves and their own safety, and thus does an incalculable amount of good toward putting over a safety program. No one can criticize efforts to build a safety record, but our Committee very strenuously disapproves the blind urge to acquire a safety record unethically, without conscience and with no regard for the employees' welfare.

If we may resort to the vernacular and use the word "chiseler," there are undoubtedly some to be found in both the professional and the lay branches, in the Medical as well as in the Safety departments of industry.

We rather believe that "The Sacred Bull" has been inflated out of all proportion by an overemphasis of cases which are the exception rather than the rule. Like the wooden horse of Troy, there are, no doubt, some men concealed within the Sacred Bull of industry — medical men and safety men alike, who must be discovered and stopped at the gate, for there is no room within the walls for any "Bull" of any kind, no matter how sacred.

It is the opinion of the Engineering Division of the St. Louis Safety Council that constructive efforts should be continued to foster and develop the cooperative relationship between the Medical and the Safety departments which is so vitally necessary to all concerned.

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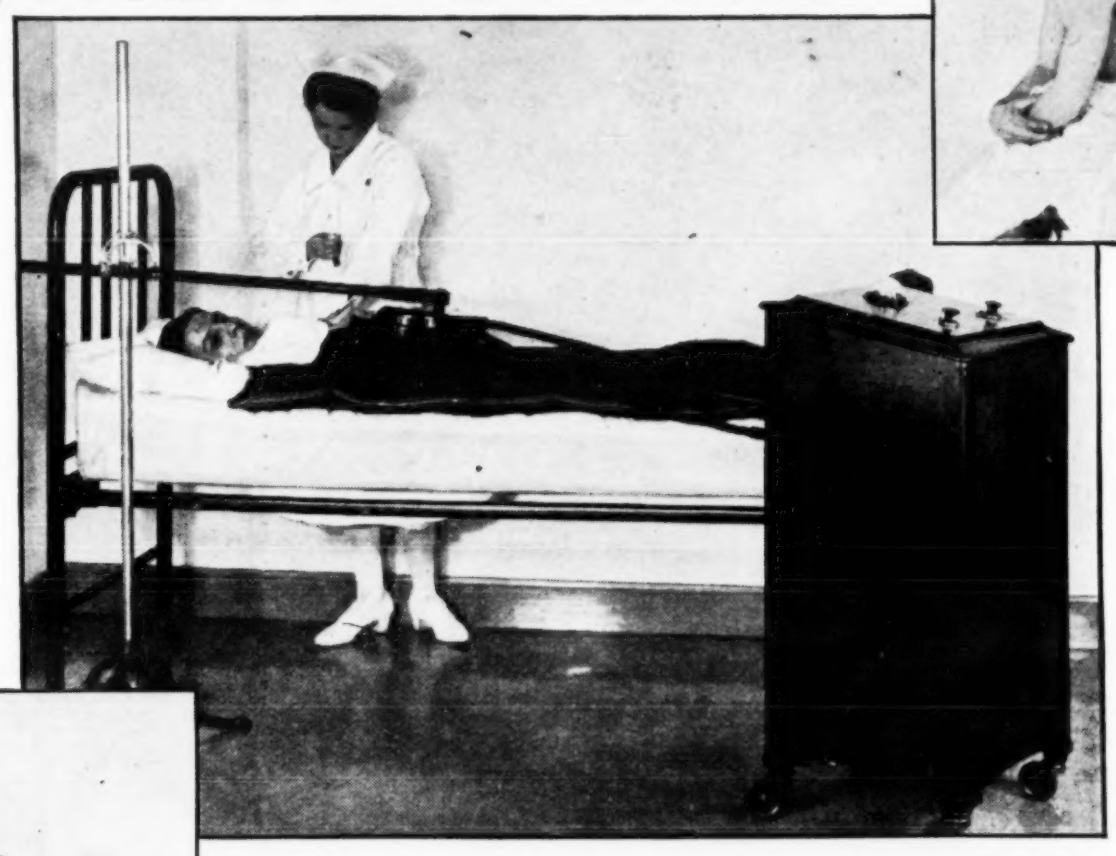

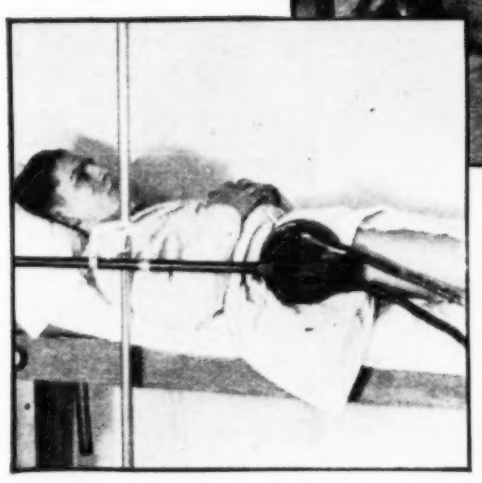

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Industrial Medicine and Surgery

Industrial Health — An Expensive Neglect*

IN the recent review of selected books of interest to public health workers one is impressed with the spurt in new works devoted to industrial health. Has the depression given industrial hygienists more time to turn to the pen? Have new hazards or new occupational diseases suddenly appeared? With so many out of work, why the increased interest in those who remain on the job?

There is usually a basic reason for every surge in human affairs. It is also invariably economic, and, one does not have far to look to find it in the subject under discussion.

Death rates have been dropping all along the line (despite the depression), and in all age groups. However, the least noticeable change has been in the industrial population and particularly in the employed themselves, as evidenced by longevity studies, tuberculosis studies, pneumonia statistics and the rates for so-called degenerative diseases in general. This great class of the population has not shared the recompenses of the period.

To one conversant with the situation 25 years ago, it looked as though selling the idea of industrial hygiene would be a "cinch" in America. There was European experience, particularly English, as a precedent. Big business economics alone would put it across. Insurance companies would naturally be interested (and two or three have been). Hanson in the Massachusetts Health Department, and Graham-Rogers in the New York Labor Department were speaking for leading states. Kober had published a volume under President Theodore Roosevelt's Homes' Commission. Labor organizations, of course, were primarily interested, and Hoffman was writing whole bulletins for the U. S. Department of Labor. And, as for the public, it was a protective and humanitarian necessity. It seemed that five to 10 years, with the collateral thrust given by the newly-created safety-first movement, would turn the trick.

There are important exceptions, of course, to any generalization, but a 25 year retrospect of industrial health in the United States really shows very little actual accomplishment, whether measured in terms of healthier conditions of work, less illness, lessened occupational disease, or lengthening of life among the industrially employed.

True, during this period much progress has been made in discoveries in this field and much has been written, but far, far too little has ever been applied. Deaf ears have largely been the recipients.

Thus, the repeated warnings against the exposure of workers to breathing mineral dusts went practically unheeded until now there is scarcely a state in the Union in which suits are not pending for the most characteristic of all occupational diseases, "silicosis"—a total in damage claims, according to some informed persons, of over 100 million dollars. It is also no defense of employers or managements to claim they were not informed of this danger since state laws recognized it back as far as the 90's with the requirements for blowers systems and proper ventilation.

It seems the cart has always been before the horse in industrial hygiene in this country, so that the deleterious effects of new methods or new substances have been first discovered in the workers themselves (as the guinea pigs) and before scientific investigations were undertaken—usually as the result of some catastrophe.

It is probably not going far astray to say that much of the lack of progress in this field has been due to political maneuvers which have cleverly diverted funds, ostensibly meant for industrial health supervision, to lay channels, and to the employment of unqualified personnel in place of trained health workers, not only physicians, but specialists in all fields having something to contribute to public health.

The remedy, we think, lies in better political leadership; one which can see the opportunity to do a great service to a vast part of the population, one which will capitalize, if we may put it that way, upon the idea of a higher regard for workers' lives and continued well-being; in short, one which will really motivate hygienic principles for all who work.

The problem therefore is much larger than the employer—even the big employer: it must reach the smallest work-place. It is larger than the labor union: It must reach the untrained and indeed the casual laborer. It is larger than the "average" which will "get by," since it demands specialized service. Finally, the problem is one which demands more of the taxpayer's money in one direction—government supervision; but it will ask a whole lot less in another—the costs of neglect and dependency.

Thus, the books of the day are truly a response to the demands of the times, and a casual examination of those referred to will show nearly all are the product of matured minds and vast experiences which are speaking for human betterment.

THE books referred to in the Editorial[1] quoted just ahead are mentioned in Dr. M. P. Ravenel's "Review of Selected Books of Interest to Public Health Workers"[2] as follows:

"Perhaps the workers in industrial hygiene have been more active than other groups. There have been many incidents which have brought the problems of industry strikingly before the public. There have been many new chemicals, some of which are poisonous, brought into use in various lines of work, which have raised new questions and led to suits for compensation. Among important books on this subject we may mention **The Human Problems of an Industrial Civilization,** by Elton Mayo (Macmillan). This is made up of the Lowell Lectures for 1933, and will interest all who have to do with employee problems . . . . **Industrial Health Service,** by Dr. L. D. Bristol (Lea & Febiger) gives the first appraisal forms (1) for smaller industries; (2) for personnel and industrial relations services . . . . **Industrial Toxicology,** by Alice Hamilton (Harper) is an excellent organized comprehensive and terse book, and is especially timely on account of the many new chemicals used in various industries, especially dyeing, rubber manufacture, metal plating, etc. . . . An outstanding book is **Industrial Maladies,** by the late Sir Thomas M. Legge (Oxford Medical Publications). Unfortunately this well known student of industrial diseases has passed away.

"Studies of much significance are **Occupation and Health** Vol. II, Letters I to Z (International Labour Office); and **Death Rates by Occupation,** by Jessamine S. Whitney, National Tuberculosis Association. The various types of pneumonoconioses are among the more urgent problems in industrial hygiene. Some firms have been forced to the wall by claims for damages. Abrasives are much used. A striking instance of injurious work is that of a tunnel bored through rock containing much quartz. Physicians, engineers, and others are called on to testify in such cases and to arbitrate and adjust claims. For them such a book as **The Pneumonokonioses (Silisosis) Bibliography and Laws,** by Davis, Salmonsen and Earlywine (Industrial Medicine) is of much value. The tunnel incident, which led to a number of suits, brought out **Symposium on Silicosis,** by Trudeau School of Tuberculosis (Employers' Mutuals, Wausau, Wis.) which is indispensable to those interested in the silicosis question."

Traumatic Surgery*

DESPITE "safety first" warnings and standard protective measures, the number of industrial accidents to workers and others is still very high, amounting to several hundred thousand per annum, in the United States.

The burden of the surgical care of the men and women thus injured, falls naturally upon that fine, sturdy body of surgeons, whose duty it is to restore the injured to his place in society as a bread-winner and support of his family.

Traumatic surgery, as this branch of surgical practice is properly termed, makes unusual demands on those who are engaged in this difficult field. The expansion of industry in the past three decades, the coincident

*Editorial in *A.J.P.H.*, July, 1935.

1. *A.J.P.H.*, July, 1935.
2. *A.J.P.H.*, April, 1935.

*Editorial in *Internat. J. Med. & Surg.*, May-June, 1935.

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IDEAL FRACTURE TREATMENT for INDUSTRIAL SURGEONS

Böhler---TREATMENT OF FRACTURES

By DR. LORENZ BOHLER, Director of the Hospital for Accidents, Vienna; Lecturer on Surgery, University of Vienna. Translation from the fourth enlarged and revised German edition by Ernest W. Hey Groves, M.S., F.R.C.S., Emeritus Professor of Surgery, University of Bristol. Buckram binding, gold stamped, 6½ x 10¼, 588 pages, 1059 illustrations, $12.00.

LORENZ BOHLER has long been internationally famous for his many successful developments in methods for the treatment of all kinds of fractures. The German editions of his book are well known in America, but their use has naturally been restricted by the limitations of language. Even a fair reading knowledge of German is not sufficient for a complete grasp of principles or a reliable understanding of details of technique. Many American surgeons have wished for a complete and reliable English translation of Dr. Bohler's work, and one is now ready. Not only a complete translation of the fourth German edition, but added material, not previously published, from Dr. Bohler's latest experience with Fractures of the Spine, and of the Neck of the Femur. Not a dull machine-like translation by an uncomprehending literary hack, but a work of appreciation done by a man who is himself a well known master-surgeon. Ernest Hey Groves, editor of the British Journal of Surgery, an authority on fractures who deliberately postponed revision of his own excellent book on the treatment of fractures in order to pay tribute to the Viennese master of the art, and make his work better available to all English-speaking surgeons. It has been well said that Dr. Bohler's book reveals he has that quality of genius which consists in the infinite capacity for taking pains. All of his painstakingly acquired knowledge and experience is now available to every American orthopedist and general surgeon.

Bohler's methods are not experiments but a carefully compiled and developed system, superior to that commonly in use, covering many years experience with a large number of cases. Many American practitioners have visited his hospital where thirty to forty visiting surgeons from all countries watch his work daily. In fact the Bohler experience and methods have been for several years increasingly used in many American cities with success and satisfaction. In the words of a well-known California surgeon, "These methods, applied in the treatment of injuries result in a lessened disability period, an earlier return to the proper industrial status of the patient, a shortened period of hospitalization, and the least possible impairment of function. The morale and physical well being of the injured are enhanced and economy to society ensues."

No surgeon should rest content until he has a copy of Bohler on his bookshelf for reference, for comparative purposes to aid him in improving his own methods and technique. The book is a liberal education in fracture treatment.

WILLIAM WOOD & CO. (Division of the Williams & Wilkins Co.) Baltimore

appearance of the automobile as a vehicle of universal use and the adoption of workmen's compensation laws, all have contributed to the creation and development of an additional and most important medical specialty,—traumatic surgery.

The railroad surgeon and the industrial surgeon generally, must be fitted by special training and extensive experience to meet problems which seldom, if ever, confront the general surgeon in the hospitals of a large city. Not only must he be a good surgeon, which is a sine qua non, but he must be prepared to deal with those peculiar forms of trauma which constitute the hazards of industry, and in addition, he must be something of a lawyer, because of the intricate compensation laws and their bearing on the economic future of the injured.

One of the most striking features of traumatic surgery is the fact that the industrial accident comes suddenly and unexpectedly upon a man presumably in good health, engaged in his usual occupation. Whether the injury has occurred in connection with a railroad, an automobile or a piece of machinery, the traumatic surgeon must be prepared to act quickly, His knowledge of what not to do is as important as his ability to determine what should be done. Upon him rests the decision which may mean recovery, or chronic invalidism or even death itself for his patient. Often enough, because of the isolated locality in which the accident has occurred, his work must be done under the most difficult conditions, with the most limited resources amid primitive surroundings, and the skill with which his work is done is attested by the splendid results which he usually obtains. In such circumstances as these, the proper setting of a fractured leg or the successful treatment of an infected hand is a far greater surgical achievement than the performance of an interval appendectomy in a well-appointed hospital.

The traumatic surgeon applies the principles of modern surgery with but one end in view—the immediate saving of life and the restoration of the injured to his place in society as a self-supporting, self-respecting social unit. More than in any other field of surgery, the lessons taught by the World War are applied and practiced in traumatic surgery. Particularly is this true of the treatment of infected wounds, compound fractures, joint injuries and methods of rehabilitation, in which fields the traumatic surgeon so notably excels.

Traumatic surgery cannot be considered fully, apart from its bearing on the workmen's compensation laws. Men and women engaged in industry have become "compensation-minded," and it may be said that every accident is a potential lawsuit or claim for compensation. The traumatic surgeon must know enough of the compensation laws to tell a jury of laymen what he saw, in a surgical sense, when he was called into the case, what he has done in the way of treatment, and what effect, if any, the injury may be expected to have on the future earning capacity of the claimant. And he must know his own responsibilities and legal rights, in order that he may testify clearly and with justice to his employer, to the injured and to his own conscience.

He must be on guard at all times for the discovery of the malingerer and the fraudulent claimant. He must foresee in every injury a possible lawsuit, and if he is as wise as he is competent, he will not fail to collect and preserve every bit of data that may have some bearing on the case. He will keep a complete record of his diagnosis and treatment, and above all, never fail to avail himself of the invaluable assistance which the Roentgen ray can give him—not only in the matter of diagnosis, but also as a guide to the progress of his treatment. The latter, in the opinion of eminent surgeons, is by far the more important of the two. The failure of the surgeon to call the Roentgen ray to his assistance may change the verdict in a lawsuit or compensation claim. As a matter of abstract fairness as well as precaution, it should be employed whenever possible because of the irrefutable testimony which it offers.

How much an injury has contributed to an exacerbation of a previously existing disease, is another of the problems which the traumatic surgeon is often called upon to solve.

It is notably his function, in justice to all concerned, to weigh all the contributing factors in the case, however unimportant they may appear, give to each its due measure of consideration, and thereby expose the malingerer and the racketeer, and render such assistance as he can to the worthy claimant.

The technique of the traumatic surgeon has been simplified and standardized in his treatment of wounds, burns, fractures and infections.

As compared with the surgeons of an earlier day, he uses but a few antiseptics, relying more than ever, on the reparative powers of nature. He prefers to effect the immediate and complete reduction of fractures and he avoids the complicated splints and gadgets which hide the injured part or cannot be removed easily. He calls upon the aid of sunshine and fresh air for infected wounds, thereby gaining the assistance of Mother Nature in stimulating healthy granulation with a minimum of scarring and deformity.

Traumatic surgery serves industry and the public generally in a most successful degree, constantly mitigating the hazards of man's conflict with the elemental forces which surround him. Society has not failed to recognize the part of traumatic surgery in the social economy, nor its great indebtedness to these tireless, faithful servants whose lives are spent repairing, so far as human effort can, the ravages of these elemental forces. Traumatic surgery stands on an enviably high plane, always aiming higher and higher, saving life and limbs, and minimizing the number of cripples and invalids in our midst. All of this is accomplished, quietly and unostentatiously, through the splendid work of that fine type of surgeon, whom we delight to honor and praise—the traumatic surgeon.

Silica Content of Lungs

THE authors* review the literature concerning the estimation of the silica content of lungs of workers subjected to dust exposure.

The methods of chemical analysis in this series of the examination of nine pairs of lungs did not permit of an accurate separation of free and combined silica, silica being reported as total silicon dioxide, which included both the free and combined forms.

Although some writers have recorded their results as milligrams per gram of dried substance, the observers in the present instance recorded their results in terms of per cent of silicon dioxide in the dried lung substance and percentage of silicon dioxide in the total ash.

The histological diagnoses were reported in each instance by Dr. Leroy U. Gardner of Saranac Laboratory and the occupational history by Dr. L. R. Harless of Gauley Bridge, W. Va.

Tabulations of the present work and the work of other investigators were recorded in the original article.

The authors found that there was a striking correlation between the percentage of silicon dioxide in the dried lung substance and the severity of silicosis as determined histologically. It was also their belief that the percentage silicon dioxide in the dried lung substance was a better criterion of the intensity of silicosis than the per cent of silica in the total ash.

Pulmonary Asbestosis

THE literature is reviewed and also the pathology of asbestosis.*

Case histories with roentgenograms illustrating typical cases of pulmonary asbestosis were submitted with this article.

The principal pathological findings are pleurisy, extensive fibrosis in the parenchyma of the lung, usually over the mid-portions and bases, and the contraction of the lungs due to this fibrosis. The finding of asbestos fibers and asbestos bodies is a usual feature, although they cannot always be demonstrated in the sputum of the living case. The fibrotic changes in the lung are the result of the low grade inflammatory reaction caused by the asbestos fibers, which are supposed to act both as a mechanical and a chemical irritant. The mechanical irritation is evidenced by the large amount of granular dust and the larger angular particles found in microscopic sections. The chemical action is probably due to the presence of silicic acid, or silica, in the mineral, which is usually estimated at 2.6%. Asbestos is very slightly soluble, and the formations of asbestosis bodies and pulmonary fibrosis are supposed to be due to this irritant action.

The so-called "asbestosis bodies," which are usually considered pathognomic of asbestosis, are never found in crude asbestos. They are invariably found in lung sections, from expressed lung juice, and very

*Drs. Clayton S. Smith and Helen L. Wikoff, in *American Journal of Public Health,* December, 1933.

*Dr. J. Donnelly, in *American Journal of Public Health,* December, 1933.

frequently in the sputum of patients. They are undoubedly formed by the deposition of certain material around the inhaled asbestos fibers. Fissures form in this material and the body separates into segments. More than 40 different varieties have been found, varying from golden-yellow to a mahogany-brown. They do not stain with the ordinary tissue stains, but frequently give the Prussian-blue reaction for iron, probably because of iron derived from the tissues. The bodies may be found in the centrifuged material from sputum which has been digested with 10% sodium hydrate, and they vary considerably in length and breadth as they do in form. They are often found with one or both ends encased in phagocytic cells, and frequently phagocytes are seen containing fragments.

It has been well demonstrated by dissolving the bodies in concentrated sulphuric acid that the middle is composed of actual asbestos fibers, which are very slightly soluble.

The symptoms and physical signs of pulmonary asbestosis simulate to a considerable degree those of fibroid tuberculosis, or atrophic pulmonary emphysema, and because of this many of these cases have previously been diagnosed pulmonary tuberculosis. A few of them are complicated by a tuberculous condition, but not by any means as frequently as in silicosis.

No really conclusive proof that asbestosis renders an individual more susceptible to an active tuberculous infection has been given. In his series of cases the author has been unable to deduce any proof that the condition has any tendency even to cause an exacerbation of activity in an old tuberculous process. The symptoms of the condition, with the exception of dyspnea, are rarely extreme. The skin frequently has an unhealthy somewhat sallow hue, and occasionally, especially in cases with long exposure to inhalation of the dust, one notices slight clubbing of the fingers, although this is far from constant. There is loss of appetite and often slowly progressive loss of weight, with accompanying lassitude. These patients almost invariably complain of chest pains, due to the tendency of the condition to involve the pleura. The cough is variable, often not excessive, and the sputum is usally scanty, being of a tenacious mucoid character. There may be blood-streaked sputum, or definite small hemorrhages, but this occurrence is fortunately not frequent. The temperature as a rule is not elevated to any appreciable extent. The most prominent and distressing symptom is dyspnea, which, very frequently, is extreme. In fact, this symptom usually first calls to the attention of the patient his need of medical attention, and renders him incapable of earning a livelihood. Sometimes, especially after an exposure over a periol of years, the dyspnea grows progressively worse, even though there has been a cessation of exposure for a considerable period of time. Occasionally this symptom is so distressing that it precludes any form of muscular exertion.

The physical signs of pulmonary asbestosis are principally those of pulmonary fibrosis, usually considerably more extensive over the lower two-thirds of the lungs. There is frequenty some muscular atrophy over the chest, and expansion is very much restricted. The percussion note over the whole chest is higher-pitched than normal except in the apices where the note is frequently resonant, probably because of compensatory emphysema. Although invariably bilateral, the impairment of resonance is more marked on the right side. The physical signs on auscultation are diminished to feeble breath sounds, prolonged and roughened expiration and either dry crackles, moist rales, or both, usually over the lower half or two-thirds of the lungs. On the whole, the physical signs are quite similar to those found in uncomplicated silicosis, fibroid tuberculosis, or atrophic pulmonary emphysema. There are no definite physical signs distinctive of the condition. Signs are supposed to develop in less than 10 years' exposure, but they are frequently discovered within two years. The shortest time in the author's series of cases, from exposure to the development of symptoms and physical signs was 18 months. The continuously progressive cases often develop extensive bronchiectasis, or engorgement of the right heart with progressive heart failure as a terminal result. Broncho-pneumonia is frequently a serious complication.

The x-ray films show a somewhat distinctive picture. According to Merewether, if films of asbestosis subjects be compared with those of victims of silicosis, the amount of disease in the former will be underestimated, because of inherent differences in the underlying pathology. The nodular distribution of the fibrosis in patients with silicosis is not often found in asbestosis. In the earlier stages of asbestosis the films present what has been frequently called a ground glass appearance. Later there is more definite mottling, but the lesions are never as dense as those of silicosis; consequently, it is difficult to divide the progress of the condition into stages. Stereoscopic films show that the ground glass appearance is caused by the development of a very fine fibrosis, and this is almost invariably seen to be much more extensive in the basal portions of the lungs.

Evidence of pleuritic involvement is often indicated by obliteration of the costo-phrenic angles, and flattening or peaking of the diaphragm. Often the diaphragm is indistinct in outline. The films sometimes show some thickening of the parietal pleura.

The outline of the heart shadow is very often "shaggy," the degree depending on the length of time of exposure to the dust. Occasionally calcareous deposits are seen not only around the hilum of the lung, but scattered in the parenchyma as well. On the whole, in well advanced cases of asbestosis, x-ray films do not show the amount of pathological change that one would expect from the clinical signs and symptoms. Even the most severe cases do not show such definite x-ray evidence as is seen in silicosis, although the area of involvement is usually somewhat extensive.

Placement of Workers

THE subject of the placement of workers from a physical standpoint is a very important one, this author* making several outlines in regard to physical characteristics to be used in this work. For instance, he believes that physical characteristics are essentially of two kinds: (1) natural—usually "fixed"; and (2) acquired—sometimes fixed but more often alterable.

Considering natural variations, persons may be roughly grouped in pairs of opposites, such as: large-small; heavy-light; fat-thin; tall-short; and slow-quick.

Considering mental and tempermental characteristics, there are also similar groups of opposites, such as: bright-dull; energetic-lazy; dextrous-clumsy; cheerful-gloomy; and cooperative-antagonistic.

It is also necessary to consider some of the different types of work with reference to physical requirements:

Heavy work—strength rather than speed. For instance agriculture, lumbering, mining and quarrying, road building, iron and steel industries, slaughtering and meat handling, freight handling, etc. For such work we would look for the stocky type, middle height or better. Not fat but well developed and muscular. Broad shoulders, deep chest, long trunk, at least 150 pounds, preferably over. Never tall or thin, or long in the legs as compared with the body.

Heavy work—requiring some speed as well as strength. For example, railroad and shipping, building and construction, helpers for many skilled trades, heavy machine operators, truckers and movers. These men may often be of medium build, well muscled but supple, and if well proportioned, men under 150 pounds are often very satisfactory.

Medium and light work—requirements are varied, as in average factory work, such as machine operation, assembling of products, stores handlers, delivery men. For such work many of the more extreme physical types may be used without disadvantage. The fat man, the thin man, the short or very tall, may often be employed without handicap or hazard. "Run of the mine" types can usually be properly placed. Here mental characteristics often are of as much or more importance than physical.

The author finally concludes that placement of workers from a physical standpoint calls for:

1. A full appreciation of physical characteristics, natural and acquired.
2. In the case of the latter, a reasonable, not an arbitrary, approach to what constitutes a defect.
3. A real knowledge by those concerned—both employment man and doctor—of the physical requirements of all jobs involved, and full cooperation in the effort at proper placement.
4. As much care in the transfer of workers as in original placement.
5. A continuing supervision of workers, especially with reference to defects acquired after hire or progressive since hire, which may affect placement.

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*DR. A. G. CRANCH, in *National Safety News*, December, 1933.

Contract Practice

CONSIDERATION is given to the so-called good and bad features of contract practice as done in southern West Virginia.*

Among the good features are these: (1) it furnishes at low cost per family adequate medical attention; (2) it furnishes family security in times of sickness; (3) as most of this work is away from medical centers it supplies rural districts with physicians; (4) it fixes responsibility both onto the employee and the physician; (5) it furnishes prompt and 24-hour medical service; (6) it carries out the installment buying plan so prevalent in America today.

The so-called bad features have been mentioned as follows:

1. It is the contention of the medical world at large that the industries are practicing medicine.

One can readily see the evil attached to a plan where the industry collects the medical fees and then pays the doctor a stipulated sum; the remainder goes to fill the coffers of the treasury of the corporation. This practice should be condemned for it only tends to promote all the evils associated with a doctor on a salary. It is believed that industry is just as interested in seeing that the men working for them, and their families, are properly cared for in a medical way as are the people themselves, and well do they know what will eventually happen by putting a physician on a salary. Industry only employs enough men to take care of each job daily and when they or their family are sick and the men have to be off duty it disrupts the organization. Therefore, industries attempt to give the employees the best medical attention possible, and they realize full well that the few dollars gained above a doctor's salary can never compensate for the loss sustained elsewhere.

2. It does away with free choice of physicians.

All men doing "list" practice in southern West Virginia are graduates of Class A medical schools and have passed the examination of the Public Health Council. If contract work were not practiced around industrial plants in all probabilities there would be only one physician in reach of the people, as no doubt collections would be so poor it would not justify more than one to locate in a community. In contract practice a physician is assured of his money at the end of the month, and this in itself results in the people having higher type of physicians than otherwise would be the case.

3. It tends to encourage solicitation, underbidding and bribery.

The majority of industries entering into contracts with physicians to do the medical practice for their employees try to be fair in the matter. They want the physician to make enough to justify capable ones to follow up that class of practice. On the other hand they do not want to see their people exploited, and are interested in seeing them get the most they can for their money.

4. It is taken advantage of by those who are able to pay adequately for medical attention.

There are not enough well paid men around the average industrial plant where contract medical practice is done to justify an outside physician trying to build up a practice among them. It would be a hard matter to draw the line among a group of employees and determine who should pay by the month and who should pay by the visit.

The author concludes that when the good features are weighed in the balance against the bad ones, it is thought that the good predominate. In times of scarcity of money, business upheavals and the inability of patients to pay, it is only natural that many should become somewhat disgruntled, but it is thought that were it not for such circumstances little or nothing would have been spoken or written of "list" practice.

* Dr. Horace R. Hicks, in *West Va. Med. Journ.*, Dec., 1933.

Comfortable Feet

HAS anyone ever said to you, "Doctor, my feet are simply killing me. What can you do for them?"* Or he or she may express the same thought to a physician in industry and say, "I must have a different job because after eight or nine o'clock in the morning my feet hurt me so badly I am in misery all over. By night I am 'all in'."

When you are confronted with a double problem of recommending and finding a new job and devising ways and means of giving that worker relief, you realize for the first time probably, the importance of his complaint.

Do we, as members of the medical profession, give patients with uncomfortable feet serious consideration? Do we examine the feet carefully, make a diagnosis and then prescribe a satisfactory treatment? It is my opinion that while such business rightly belongs within the realm of the medical profession, the doctors, as a whole, are either delegating or permitting such work to be done by people who know little or nothing about feet, shoes, or lasts. If advice is given, it is usually the casual remark, "Soak your feet every night in hot water, or get a pair of arch supports and wear them in your shoes."

Feet are made uncomfortable by a large number of different causes; but the scope of this paper is to include only those which can be relieved by shoes or the modification of shoes. It is not the intention of the writer to deal with operative, orthopedic, or some of the dermatological conditions, but with what he commonly calls foot disabilities.

I present, then, for consideration, pronation or what is otherwise known as weakness of the feet, inward rotation or acquired flat-feet; relaxation of a part or all of the anterior arch of the foot, bunions, corns, callouses, tailor bunions, Morton's toe, bursitis, ingrown nails, congenital shortening of the metatarsals, and spurs.

All of the above mentioned conditions can be relieved in part or in whole by the proper fitting and modification of shoes.

*Dr. C. L. Ferguson, Portsmouth, Ohio, before the Section on Public Health and Preventive Medicine, Ohio State Medical Association, at the 88th Annual Meeting, Columbus, October 4-6, 1934; published in *Ohio State Medical Journal*, July 1, 1935.

There are two other disabilities so common that they should be mentioned, though they are not effected or caused by foot wear. Neither are they improved by it, but they do complicate food disabilities. They are verruca and "athlete's foot."

The writer considers himself fortunate in having been connected with a large shoe manufacturing company for the past 13 years, because he has had an excellent opportunity to observe foot symptoms complained of by anyone of its 3500 employees as they go about their daily routine of many different kinds of work. To supplement this experience, transients from all over the United States consult us about foot problems. Dealers, likewise, write in for information concerning customers who are attempting to get foot relief.

The relief of foot disabilities is comparatively simple after one fully understands the cause of the symptoms. During the past two years, much hocuspocus has been handed out by so-called foot specialists, some of whom never saw the outside of Gray's Anatomy. During the same time, shoe manufacturers became hysterical because they heard of a mysterious something, a magic touch, if you please, which was likely to revolutionize the entire shoe business and, incidentally, cure all foot troubles from corns to arthritis, if a certain type of shoe is worn.

While extensive foot propaganda was being distributed, the public became foot conscious and now hundreds of mushroom "foot specialists" have sprung up to take care of the feet of your wife, daughter, and patients.

Without removing the cause, such "specialists" are simply telling your patients how their feet should be jerked or twisted in order to be cured.

SHOES, it can truly be said, are the cause of the majority of foot discomforts. Natives of countries where it is the custom to go barefooted have but little, if any, trouble with their feet. They can carry heavy loads on their shoulders or heads and subject their feet to tremendous strain with impunity. Likewise, the feet of millions of workers are subjected daily to a tremendous strain because of the weight imposed upon them while poorly balanced and crowded into shoes too short or too narrow.

It is estimated that the average person who is on his feet takes 19,500 steps daily. If he weighs 150 pounds, he will pound into his shoes about three million pounds per day. Take for example the individual who weighs 200 pounds, his or her feet are subjected to much more strain. Other causes of foot disabilities are occupation, illness, and a change in the style of lasts.

A woman missionary recently told me her experience in buying two pairs of shoes of the same size and the same make. One pair was absolutely comfortable, while the other produced untold misery even though riding on a pullman. This experience would seem hard to explain in view of the fact that she had two good feet. Measurement of the shoes showed one pair, the comfortable pair, to be 3/8 inch longer and 1/8 inch wider than the uncomfortable pair. A difference in the style of lasts was responsible

for absolute comfort in one pair of shoes and agony in the other.

FIRST, examine the shoes. These will, often times, tell as much as examination of the feet. Observe how the heels and soles are worn. Is the shoe twisted? Note the height of heel.

Then have the patient remove stockings and examine feet for tender areas. Certain areas of tenderness indicate certain definite abnormal conditions. Make pressure, with the thumb, over the entire plantar area, over the sustentaculum tali, tibial ridge, and over joints of the foot and ankle. Test the motility of the joints for the degree of flexibility and tenderness. Next, have the patient stand on a glass top stand which is about 14 inches high. A slanting mirror under the glass top will reveal the degree of flatness or cavus. It will also reveal areas carrying excessive weight associated with callous.

While on the stand, it is wise to check for rotation of the foot. This can be determined by suspending a plumb line from the center of each patella to the dorsum of the foot. Normally, the plumb bob should point to a spot in the region of the second metatarsal. If it points to the third or fourth metatarsal, a pronation exists, providing the legs are straight.

Tenderness over a joint indicates, as a rule, the presence of arthritis. If such is suspected, it is then necessary to make a complete physical examination to determine if possible, the cause. What, then, do we find by such examination? If tenderness is found over the sustentaculum tali, spring ligament, and tibial ridge, and if your plumb line points to a spot outward from the second metatarsal, and if the shoes show wear on the inside, we can make a diagnosis of pronation. It is the writer's belief that pronation is the major cause of most of the very disagreeable foot symptoms. If a callous is found under the distal heads of the metatarsals, we say there is a relaxation of the anterior arch.

Tenderness under the heel associated with the patient's subjective symptoms and a radiograph showing a calcarious formation extending from the oscalcis in line with the plantar ligament justify us in making a diagnosis of a spur.

A bunion needs no describing because its appearance is familiar to every one. A tailor's bunion is a similar condition existing in the first joint of the little toe.

Subjective symptoms and tenderness along the fourth metatarsal with a history of pain extending to the end of the fourth toe are sufficient for a diagnosis of Morton's toe.

Bursitis, a very common condition, is most frequently found over the lower end of the tendon Achilles. It is characterized by tenderness and swelling over this area.

Uncomfortable feet presenting the various conditions just mentioned cause symptoms elsewhere. Pain in the feet is referred to the calves of the legs, knees, thighs, and backs. These symptoms located elsewhere are often diagnosed as rheumatism, arthritis of the knees, sciatica, sacro-iliac sprain and lumbago.

It is extremely interesting to observe, in many instances, the disappearance of such symptoms by relieving uncomfortable feet.

FOR the past two or three decades, modern industry has, through its medical departments and hospitals, endeavored to do much to diminish morbidity by annual and semi-annual examinations. Foci of infection have been sought in the usual locations and eliminated where possible. The elimination of such foci has meant more comfort for the worker and less lost time.

Modern industry has installed up-to-date heating, lighting, and ventilating systems, thus providing a deserving comfort for the worker. In spite of all that has been done, industry can go a step farther and provide relief for foot disabilities which are interfering with the worker's comfort and his earning capacity. It is estimated that from 80% to 85% of the population have some sort of foot disability.

Such disability is just as distracting and interferes with one's ability to concentrate and produce as does any other kind of pain elsewhere in the body.

HOW then, can relief be offered such patients? The treatment of foot disabilities is comparatively simple. Some equipment, of course, is necessary. This includes a standard foot measuring device, an ample assortment of the various sizes of shoes that come within a sensible classification, a person who understands the fitting of shoes, metatarsal pads of different sizes, piano felt, cutting block, sharp knife, scissors, leather, kid skins, channel cement and a brush. An x-ray is invaluable and should be included.

It is the writer's experience that, excluding arthritis cases, foot relief can be secured either immediately or within a comparatively short time. Some of the most severe cases report complete relief in three to four weeks.

Pronation can be relieved by properly balancing the foot in a shoe of proper size. I mean a shoe which is of the proper length and with sufficient toe room. Both feet should always be measured to assure the patient of proper fit because one foot is frequently found to be a size longer and wider than the other. Always fit the larger foot. If a wide variation exists, then shoes of different sizes will give the greatest degree of comfort. Personally, I prefer a rigid shank shoe because pronation cases require sturdy support for a foundation. If the worn shoes of such patients are examined, especially if the shoes are inexpensive and flimsy, they will be found to be twisted entirely out of shape. In the rigid shank shoe a piece of skivel leather, 3¼ inches long and 9/8 inch wide for men, and a smaller size for women, is cemented along the inner side of the shoe and on top of the inner-sole. An oval flare extends over the inner quarter ⅝ of an inch and provides support under the longitudinal arch. Sometimes, it is necessary to place a piece of felt on top of this piece of leather in order to balance the foot properly.

If a flexible shank shoe is used to relieve pronation, a new heel should be built with the inside of the heel extending forward about ¾ inch. Such a heel is known as a Thomas heel. This type of heel provides the necessary support under the scaphoid bone and it also tends to prevent the oscalcis from rotating inward. Heels should never be over 12/8 inch high. An 8/8 inch heel is better. However, cases which have a marked contraction of the tendo Achilles should be let down gradually or advised to wear low heel shoes for a short time only each day until the tendon becomes sufficiently stretched. In marked cases of pronation, the function of the Thomas heel can be supplemented by making the inner side of the sole and heel ⅛ inch thicker.

The symptoms of a relaxation of the anterior arch can be relieved almost instantly by using a sensible shoe in which is placed a metatarsal pad. Each individual rendering relief prefers his own kind of pad. Personally, I prefer one of sponge rubber which is about the size of a dollar.

The success of these metatarsal pads depends upon the proper placement in the shoe. They should not be placed under the distal heads of the metatarsals, but should be placed just back of them to maintain a normal relation of the metatarsals and at the same time to feel comfortable. I like to place these pads myself in order to assure comfort. Sometimes, I have to take the pad out five or six times and replace it in order to get it properly located. Very often the placement of it forward, backward, or to either side 1/16 of an inch is sufficient to make the patient say, "Now that is comfortable."

Morton's toe requires a properly fitted shoe with emphasis on the width. In addition a metatarsal pad is necessary. Bunions, whether of the big or little toe, first need shoes built over a straight last in order to permit the toes to spread so as to relieve pressure. Corns and callouses will be relieved, or they may go away entirely, if shoes of proper size are worn. Corn cures are not necessary. Callouses under the anterior arch are greatly helped by low heel shoes with metatarsal pads.

Since spurs are caused by a chronic irritation due to foot strain, it is only necessary in most instances to relieve this strain by a low heel shoe, properly balanced to take the strain off the plantar ligament.

Bursitis over the Achilles tendon can be cured by removing the shoe pressure at this point. Felt and cement are useful agents here. A small piece of felt 2 inches long and 1 inch wide —⅛ inch to ¼ inch thick on one edge tapered to nothing at the other is cemented in the back of the heel of the shoe. This piece of felt keeps the foot far enough forward so that the pressure is removed from the heel, and thus provides immediate relief. Here again a better fitting shoe is necessary.

The congenital shortening of one or more of the metatarsals is rare; but when it does occur, such deformity interferes with the normal function of the foot.

A simple remedy which will often give complete relief is to place a long slender piece of felt about ⅛ inch thick and ¾ inch wide under the short metatarsal and allow it to extend under the distal head and under the proximal half of the toe.

IN CONCLUSION, I wish to reiterate that it is unnecessary for per-

sons with foot disabilities to suffer physical and mental agony; that the correction is simple; that the physician should know the fundamental principles of shoe and last making; and that, in most cases, a properly fitted shoe or a modification of the shoe will relieve the foot disability and symptoms incorrectly diagnosed.

Discussion

P. A. DAVIS, M.D., F.A.P.H.A., Akron: I want to commend Dr. Ferguson on this paper. It gave me a great amount of pleasure and satisfaction to read the copy he sent to me, for I could appreciate the problems he has attempted to solve. When we make our debut into this world, if our progenitors have not broken the good laws of nature we are supposed to have two good feet with four principal arches.

From this time on it is a battle of the arches against environment and disease. Hundreds of years ago the aborigines won and preserved their arches and had very little foot trouble. Today with our ultra-modern civilization the arches are slowly being levelled. The attacking forces which are securely entranched at the present time are the following:

1. Man-made devices which inhibit the normal functions of the arches.
2. Solidification of the battle ground by cement, marble, hard wood, and importations from the black hole of Trinidad.
3. The counter attacks of our microscopic enemies, especially Major Staph and Captain Strepto.
4. The constant but ever present forces directed by gravity attacking us from the air.
5. The iron masked God Auto who has gastrocnemius and femoris in his grip and refuses to give them a leave of absence.
6. Counter forces which have blockaded A, B, C, and D supplies.

In 1919-20, I examined one division of the army of this war of Arches consisting of 2014 men and found that 16.5% had received disabilities to some degree to their internal anterior posterior arches.

What are we to do with our casualties and how are we going to win this war? You have just heard a very excellent proposal by one member of the staff but victory cannot be accomplished single handed. My proposal is to limit and restrict or annihilate enemies one to five inclusive and remove the blockade from six so that supplies are available. Casualties should be treated according to their diagnosis, that is, whether it is infectious, due to mechanical injury or to defect in nourishment.

I am somewhat skeptical about the use of arch supports or foot splints over a long period of time for they soon become part of the individual. I believe that reconstruction exercises, removal of the cause or causes and a regulation of the individual's activity will produce more beneficial and lasting results. I have seen 3rd degree flat foot completely corrected over a period of time by such procedures.

Seriously, we have not given much thought to these conditions and I do not know how much time and money is lost to the individual, but it must be enormous. We should give this some thought, especially those connected with industry and the supervision of the growing child. Again I recommend the perusal of the manucript by Dr. Ferguson.

Silicosis

PNEUMONOCONIOSIS* is the reaction of the lungs to the presence of any kind of dust. Silicosis is the reaction of the body, especially the lungs, to the presence of silicon dioxide, or silica, in a finely divided state. It is widespread fibrosis.

During the last decade silicosis has come to hold a prominent place in the medical world, because of interesting pathological and clinical standpoints, and mostly, perhaps, because of its relationship to many modern industries and, association with tuberculosis.

Silicosis has been known for years. In 1700 Ramazinni mentioned the disease of stonecutters who, as he says, "oftentimes suck in by inspiration the sharp rough and cornered small splinters and particles that fly off so that they are usually troubled by cough, and some of them turn asthmatic and consumptive . . . and in dissecting the corpse of such artificers, lungs have been stuck with little stones." As recently, however, as my own medical school days, no particular importance was attached to it and there was no accurate description of its pathology. However, the two conditions "miners' dyspnea" and "miners' phthisis or consumption" have long been recognized in mining communities, not only by medical men but by the laity. The former is shortness of breath only, or simple silicosis; the latter, shortness of breath and wasting—silicosis and tuberculosis. Lanza and Vane in a startling paper on the prevalence of silicosis and the incidence of tuberculosis show that mining is still the most important industry in the production of silicosis and tuberculosis. Their figures are that zinc and lead miners have almost 20 times the expected death rate from tuberculosis of the general population. Copper miners have nine times this rate, gold and silver miners eight times, and iron miners two and a half times. Granite and sandstone cutters have nearly 10 times the expected rate, and metal workers, chippers, moulders, etc.—up to six times. Moreover, these authors produce evidence to show that more than 500,000 industrial workers in the United States are dangerously exposed to silica dust and therefore are in the group having increased frequency of tuberculosis.

It is stated on good authority, although mining is the chief industry of Arizona, and metaliferous ores all contain a high per cent of silica, that silicosis is not a serious health hazard in this state. This is due to adequate ventilation, the humidifying of mine air, wet drilling and the constant use of spraying to keep dust down. I cannot vouch for the general applicability of this statement.

No dust except that containing a high percentage of silica produces a condition like silicosis. Coal, limestone, organic dusts, etc., show no similar effect on the lungs or elsewhere in the body. This is emphasized by work at the Saranac Laboratory. The dusting of guinea pigs for long periods, using several materials, was followed by a silicosis-like condition only where very fine silica dust was used. Miller, Sayers and Yant injected into the peritoneal cavities of guinea pigs suspensions of fine particles of quartz, chert, ferrous oxide, coal, limestone, etc., and found all were either inert or absorbed without injury to the tissues except quartz and chert, which are high in silicon dioxide and which produced nodular proliferative lesions. The British geologist W. R. Jones recently propounded the theory, after study of rock dust in a number of mining fields and the lungs of miners dying with silicosis, that the body reaction in the disease is in response to the presence of fibers of sericite, minute mica-like needles of a hydrated silicate of potassium and aluminum, rather than to the crystals of silicon dioxide. This requires further study.

Some maintain that the sharp angles and edges of the silica crystals cause trauma to the alveolar walls of the lungs. Most workers, however, think that there is a chemical action i.e., the silica particles dissolve in the faintly alkaline juices of the tissue cells and phagocytes, and the resulting solution is poisonous, stimulating nodulation and fibrosis. Gye and associates found that colloidal silica injected intravenously was deadly poisonous in large doses, but in small doses only poisonous enough to produce fibrosis. While many students of the condition do not subscribe to Jones' view, it might fit in with the mechanical theory as the angles and edges of the exceedingly fine particles are sharp and penetrating, or with the chemical, where much surface is exposed to tissue juices, and the silicate being more soluble than silicon dioxide. I have found no evidence that silicon dioxide actually dissolves in tissue juices, at least in vitro. Chemists have questioned its solubility as they consider silicon dioxide to be the most insoluble of minerals. The action may be colloidal. By whatever process the injury is accomplished, silica dust when breathed into the lungs produces fibrosis reducing lung power, and predisposing to tuberculosis.

The tissue reaction is inversely proportional to the size of the particles, and directly proportional to their number—i.e., the finer the dust and greater the number of particles, the more severe the reaction. The particles must be smaller than 10 microns in diameter and more than 10 million per cubic foot to produce appreciable effect. Other factors, chiefly length of exposure, and rate of respiration—a function of purity of air breathed and effort expended—bear on the development of the disease. Once there has been an exposure to silica dust sufficient to establish even a minimal silicosis, the disease progresses even though exposure has been terminated, and death often is directly attributable to silicosis or silico-tuberculosis.

The pathogenesis of silicosis consists of nodulation and fibrosis. Gard-

*Dr. George Thorngate, *in Southwestern Medicine*, July, 1935.

ner's description is particularly illuminating. Particles that get past the protective mechanisms of the upper air passages reach the respiratory bronchioles and alveoli. The first reaction is non-specific—that of the lungs to any foreign body. The particles are engulfed in the ameboid phagocytes of the nearby alveolar walls. These cells accumulate in the sub-pleural air spaces, the walls of which thicken. The cells, which have taken in a few silica particles, move toward the lymphatic system and collect in nodular masses about the lymphoid tissue at the periphery. These silica containing phagocytes pass through the walls of the lymphatics and excite fibrous nodulosis in the areolar tissue. The reaction is at first linear in distribution and tends to thicken the structures through which lymphatics pass, viz: Bronchi, pulmonary arteries and veins, interlobular septums and pleura. Later this linear phase is overshadowed by nodular formations. The fibrous nodules in the lymphoid tissue resulting from the physico-chemical properties of silica encroach on and compress the adjacent lymph vessels so that the flow of lymph is impeded. Hence there is an increasing tendency for phagocytes to migrate outward through the walls of the vessels. When lymphatic obstruction is advanced, phagocytes carry the dust to all parts of the pulmonary framework with the formation of dense interstitial fibrosis and multiple nodules in the walls of the terminal air spaces. This reduces the size of their lumen with an intrinsic reduction in lung capacity. Lung tissue not involved in the fibrosis becomes emphysematous as a compensatory measure.

The most common and, serious complication of silicosis is tuberculosis. This may have been latent previous to the time of the dusty occupation, or it may have been acquired afterward. Silica has the power to reactivate a healed focus if tubercle bacille are still present. The combined disease progresses rapidly. Haldane states that silicosis causes the lungs to become more susceptible to tuberculosis. Cummings thinks that the presence of silica acts as an adjucant to the multiplication of tubercle bacilli. Gardner says 75% of the persons who develop silicosis die of tuberculosis because silica dust produces definite specific susceptibility to tuberculosis. In the characteristic lesion of silicosis modified by tubercle infection the individual nodules are no longer clean cut and sharply defined, but the borders are irregular and extend into the walls of adjacent air spaces. The centers of the nodules are often cascous but tubercle bacilli are rare. Nodules and tuberculous foci are bound together by dense fibrous material.

Dyspnea is the cardinal and ever present symptom; the constant physical sign is reduced chest expansion. Patients usually are well nourished and seem robust. Fever is absent and blood pressure is not far from normal. Marked loss of weight elevation of temperature or fall in blood pressure should at once suggest the development of tuberculosis. The progress of silicosis is usually divided into three stages. In the first or anteprimary stage of the South African writers about the only evidence is a slight shortness of breath on exertion and a mild unproductive cough. There is a slight reduction in chest expansion; work capacity is not much impaired. Occasionally rales can be heard at the bases. The second or primary stage has definite dyspnea on exertion and a loss of elasticity of the thorax. Frequently there are pains in the chest and an irritative cough. The capacity for work is considerably reduced. In the third or secondary stage the shortness of breath is severe and distressing. Cough is persistent but not productive. Capacity for work becomes almost nil. Chest expansion is markedly reduced often with clubbing of the fingers. Throughout increasing diminution in the intensity of the breath sounds exist the result of emphysema and fibrosis with decrease in elasticity of the lung tissue.

The most illuminating procedure for ante-mortem study of silicosis is the x-ray examination. I have adopted the terminology and description of Pancoast and Pendergrass for the stages mentioned above First — the perivascular - peribronchial - lymph node phase: The hilar shadows are more prominent than usual and of greater density and homogeneity; trunk shadows and linear markings show increased prominence. Second —the early interstitial phase: There is a faint homogenous haze appearing first in the right mid or lower lung field, then in the left, gradually spreading; small discrete nodules may or may not coexist; the hilar and trunk markings are noticeably accentuated. Third — the nodular phase: This is the most characteristic; there are small dense discrete nodules throughout both lungs; the pleura is not involved; smaller nodules become larger and conglomerate. There is interference with the excursion of the diaphragm possibly from interstitial fibrosis and emphysema, and sometimes there is peaking of the domes.

Modification of silicosis by tuberculosis is shown on the x-ray film by the outlines of the previously discrete nodules, becoming hazy or fluffy, and a definite tendency toward aggregation of the nodules. There are dense shadows in the midportions of both lungs. It is a strange phenomenon that not only the nodules in close contact with the tuberculosis foci but those in every part of the lung show this alteration.

For diagnosis, a thorough and chronological occupational history also is extremely valuable. Evidence of exposure to silica dust, or lack of such evidence must be of significance.

As to prognosis: silicosis is an incurable disease. Removal from further exposure may prolong life, and avoidance of exertion may relieve respiratory distress. Landis says, "knowing the type of dust and the length of exposure we can predict the amount of damage" and so, to a certain extent, the outlook for life and comfort.

Prevention of silicosis—the only hope in this sad situation—must be attempted along two lines: (1) the elimination of dust in mine and shop, by adequate ventilation and removal of dust by suction, etc., by wet drilling and the copious use of water to keep the dust down; (2) examination of the worker by x-ray before his starting to work, and subsequent examinations every three months; prompt removal from exposure with evidence of silicosis.

The German investigators have a simple instrument to determine the ability of a worker's nose to fix dust. If his nose's fixation power is below 29%, he is not allowed to work in dusty trades as it has been found that those in the low fixation group are susceptible to silica dust while the greater the fixation power of the nose, the less susceptible is the worker to the dust. Such a procedure might be of value in employment offices of dusty industries in this country.

As I see it, compensation should run parallel with knowledge. An employer, who makes every effort according to existing knowledge to prevent his employees from acquiring silicosis, should not be subject to compensation claims. Negligence or lack of concern for employees, however, should lay the operator open to just claims for disability compensation.

Discussion

JOHN E. BACON, M.D.: I wish to compliment Dr. Thorngate on a very able presentation of the pathology of silicosis. The question of silicosis is becoming a sort of hysteria even among the laity. Recently a newspaper reporter in the daily press compared the damage impaired by silicosis to that from war. The uppermost point to be considered is diagnosis. It is my belief that only three or four of the men here present are able to diagnose silicosis. And I say this with all due respect for the professional ability of every man present.

The stages of silicosis overlap, and other factors enter, confusing accurate diagnosis. A complete history of the case is not only essential, but mandatory. The habits of the man before and after contracting the suspected disease are of high importance. Then, too, unless a physician can thoroughly read plates a false diagnosis is apt to occur. Mining men change their abode frequently, or did when mining was at a high peak. They work in Canada, Alaska, South America, and in various mining sections of our own country. The southwest gets many men who have worked here, there, and yonder. The last mining company employing the man in question is subject to his claim of contracting the disease. I say the case should be thoroughly investigated from every source in fairness to all concerned. The Arizona mining code has been amplified since 1912. The mining inspector carefully studies all cases of accident and health impairment. In 1916 the dust hazard was recognized. Dr. Harrington of the U. S. Bureau made recommendations which have been thoroughly carried out. There has been continuous sprinkling in the mines, on dumps, and perfect ventilation systems have operated for years. Every effort has

been made by the mines to meet the humanitarian, as well as legal, obligations to protect against silicosis.

DR. FRED G. HOLMES: What Dr. Bacon says relative to tracing the original source of silicosis is often true. I know of a miner who left mining and for 22 years engaged in farming. He contracted the "flu," did not make a satisfactory recovery. The x-ray revealed silicosis. Death eventuated. Having been away from mines for a period of 22 years, it was impossible to trace the source of this man's silicosis. At Saranac I had the privilege of observing slides showing the progress of the disease with guinea pigs. The revelations were of remarkable interest. It takes a careful reading of plates to diagnosis accurately.

DR. R. O. SCHOFIELD: During the earlier days of construction at Boulder Dam about 8000 men were employed, many of whom for the driving of the large diversion tunnels. This type of workman often claimed to have had considerable previous experience as a "hard rock" miner. During the work there occurred an epidemic of respiratory infection which was equally prevalent among the people of the city as well as among the miners. It is interesting to note that in reviewing chest plates that were taken at that time of men who were considered hard rock miners, together with chest plates taken of this same type of employee and other employees during subsequent years, in only 23 cases has there been any x-ray evidence of fibrotic or nodular lung changes that might be interpreted as a possible condition of silicosis. Many of these cases were accidentally discovered when radiographs were taken for dorsal spine or rib injuries while others were taken during the epidemic of infections and pneumonia. The correlation of data surrounding these cases where x-ray findings have revealed lung changes indicate that silicosis has never played an important role in the morbidity of men employed at Boulder Dam.

Jute Dermatitis

TO THE EDITOR (J. A. M. A.*): Is there such a thing as poisoning from the oil used in softening sisal in the manufacture of jute or even in the jute or sisal itself which would give what workmen in such plants call "oil poisoning"? I have a patient who has had a reddened, scaly, itching, chronic, recurrent, pustular umbilicated dermatitis for more than a year. It cleared up with injections of boiled milk, but I should like to know if there is any connection with the oil or if it is mere coincidence. M. D., Kentucky.

ANSWER.—Sisal or jute dermatitis is a fairly well known industrial disease entity. The action is attributable partly to the soaps, fish and mineral oils employed in the manipulation of the vegetable fiber and partly to the mechanical action of the fibers themselves. Also allergy may play some part in the causation of this condition. From an International Labor Office publication (1930), Encyclopedia of Pathology, Hygiene and Social Welfare, brochure 212, the following is taken:

"Skin affections, characterized by irritation of the skin, redness and swelling, dry eczema, papillary hypertrophy and inflammation, advancing even to suppuration, have been reported in people handling jute where the thread was impregnated with a solution of yellow soap, impure fish oil and mineral oil.

"The coloring matters and oils handled in manipulating jute are the cause of the folliculitis observed, notably in India. The lesion is nonsuppurative in character brought on by mechanical obliteration of the orifice of the sebaceous glands by debris from the corneal layer, the exfoliation of which is obstructed by the presence of the oil on the skin. The accumulation of this debris is frequent among the natives, who do not use detergent soap sufficiently, water alone being insufficient in these cases."

The entry of mycotic organisms frequently prolongs the duration of this type of industrial dermatitis.

* *J.A.M.A.*, July 6, 1935.

Wax Spraying in Printing

TO THE EDITOR (J. A.M. A.*): An inquiry has come to my desk as to the possible harmful results arising from wax spraying in the printing industry. We do not use this method at the Government Printing Office and therefore have no data on the subject. Certain investigations made in one of the larger printing plants in England seem to point to harmful results to workers, even to the extent that cancer may follow its use. Have you any data of investigation made along this line? D. P. Bush, M. D., Washington, D. C.

ANSWER: According to the U. S. Bureau of Standards (Lewkowitsch: Chemical Technology and Analysis of Oils, Fats and Waxes, ed. 6, New York, Macmillan Company, 1923, p. 281) (1) printers' wax consists essentially of ozokerite, a natural bituminous product, waxlike, occuring near petroleum springs. Ozokerite used in this country is obtained from Utah and from Poland. It is freed from asphalt and minerals and is then mixed with beeswax, paraffin, rosin, petrolatum, turpentine and burgundy pitch. No injurious actions on the skin should follow contact with these substances. None of them is cancer producing. British printers' wax may differ from American and possibly may contain some of the carcinogenic agents that are present in the final products of tar distillation. It is well known that the oil pressed out in the final stage of paraffin production is carcinogenic (Heller, Imre: Occupational Cancers, **J. Indust. Hyg. 12**:169 [May] 1930).

* *J.A.M.A.*, July 20, 1935.

Bakers' Dermatitis

TO THE EDITOR (J. A. M. A.)*: A young woman who works in a bakery handling and selling bread and cakes came to me with a skin condition on her fingers. Two fingers on each hand had round, raised flat vesicles about 1 cm. in diameter, the borders of which appeared indurated and reddened. The vesicles dried in about twenty-four hours, leaving a raw, chapped and fissured skin, which itched. Is ringworm infection a likely diagnosis? Could this infection have come from the bread? Would this infection be more likely to involve skin with small unhealed cuts? How could the diagnosis have been made definite? M. D., New York.

ANSWER: Since early times bakers, pastry cooks and confectioners have been held to be liable to a wide variety of skin disorders. Modern research seems to show that "bakers' eczema" is caused not by any ordinary ingredient of the bread but by one of the so-called flour improvers, usually ammonium persulphate, sometimes calcium acid phosphate. In regard to the former, Australian reports show that in "allergic" persons as little as one part in a hundred thousand may cause an eczema. In regard to the latter, Prosser White found confectioners' self-rising flour very irritating in patch tests and attributed this to the presence of acid calcium phosphate, from 4½ to 6 pounds in 280 pounds.

Deliquescent compounds, such as salt and sugar, are unduly active when in crystals, dehydrating the tissues they touch. Packers of sweets as well as makers frequently have skin lesions on the hands. The French have written much on the subject of the "mal des confiseurs," the typical form of which is onychia, affecting chiefly the middle and ring fingers, but there are also cases of bullae and pustules without onychia. White gives a case of dermatitis from handling cinnamon-sugar, in which the cinnamon was found to be the causative agent.

Most writers accept the term "confectioners' itch" or dermatitis or psoriasis, but White holds that a distinction must be made between skin lesions that are merely incidental to certain occupations and those which are actually due to the occupation. An eczema can be called occupational with certainty only if at least one of the ingredients handled gives a positive result with the patch test.

These conditions are described by:

White, R. P.: The Dermatergoses or Occupational Affections of the Skin, ed. 4, London, 1934, pp. 252-259.

Bowen, J. T., in Diseases of Occupation, by Kober and Hanson, Philadelphia, P. Blakiston's Son & Co., 1916, p. 358.

Ullmann, Karl; Oppenheim, Moriz, and Rille, J. H.: Die Schadigungen der Haut durch Beruf und gewerbliche Arbeit, Leipzig, Leopold Voss 2: 204, 1926.

No Common Law Action For Occupational Disease

JOE SYLVESTER,[1] plaintiff below, appealed from the judgment of the Circuit court of Cook County dismissing his amended complaint, on motion of the The Buda Company, a corporation, defendant, in an

1. *Joe Sylvester* v. *Buda Company*, Appellate Court, First District, Illinois. Affirmed July 5, 1935.

action charging that while employed by the defendant corporation he contracted an occupational disease.

The original complaint alleged a violation of Section 1 of the Occupation Diseases act and of sections 12 and 13 of the Health, Safety and Comfort act. During the pendency of the suit, the Supreme court declared section 1 of the Occupational Diseases act and Sections 12 and 13 of the Health, Safety and Comfort Act unconstitutional because they were vague, indefinite and uncertain.[2]

Following these decisions, the plaintiff, pursuant to an order of court, amended the complaint so as to set up a cause of action based on the common law, and charged that by reason of the defendant's failure to provide a reasonably safe place to work in, etc., he inhaled dust, as a result of which he contracted the disease complained of.

Defendant then moved to strike the amended complaint; the motion was allowed; and the judgment here appealed from followed.

The question for determination was whether or not a common law right of action to recover for an occupational disease existed at common law.

Mr. Justice O'Connor who rendered the opinion of the court, ruled that there was no such action, and upheld the judgment of the court below saying:

"We have been favored with excellent briefs by both parties, who agree that the only question before this court is whether there is a common law right of action for an occupational disease as alleged in the amended complaint. . . .

"Counsel for plaintiff has cited a number of authorities in which he claims it is held that one may recover for injuries sustained or occasioned by occupational diseases. We do not stop to analyse or distinguish these cases because we are of the opinion that plaintiff's contention has been decided adversely to him by the Supreme court of this state and of many other states.

"In considering the question of the invalidity of Section 1 of the Occupational Disease act of this state, the court, after discussing the several sections of that act, said:[3] 'By this legislation the legislature recognized the existence of occupational diseases.'[4] And continuing: 'The plaintiff argues, however, that a jury is especially equipped to determine the standard of reasonable and approved devices, and asserts that the history of the common law is replete with instances of juries passing on what is "reasonable."

" 'This argument ignores the fact that the liability here is of statuory origin and did not exist at common law.'

"And in considering this same question the court said[5]: 'This type of legislation was a complete stranger to the common law, and section 1 under consideration here has no common law origin or history . . . . '

"Counsel for plaintiff cites cases which he contends hold in effect that an action at common law would lie for an occupational disease, and says that the statements in the Parks and Boshuizen cases, above referred to, to the effect that an occupational disease would not lie at common law, are 'pure dictum.' We do not stop here to discuss the authorities cited by counsel because we do not agree with the counsel's contention that the language of the opinions in the two cases is dictum because a reading of the opinions disclosed the fact that the court was unable to find any common law precedent to sustain an action for an occupational disease.

"The judgment of the Circuit Court of Cook County is affirmed."

The Point of View

Insurance

NEW YORK:[1] A substantial number of bills affecting benefits and procedure, under the Workmen's Compensation Act, were considered and some of them enacted. Of the latter, there were only two of major importance. The first was the so-called Medical Bill, introduced as an administration measure and effective July 1, 1935. The net effect of this Act is to obstruct seriously carriers and employers from securing efficient and economical medical and surgical treatment of compensable injuries. It will apparently necessitate the discontinuance of most plant hospitals, so far as the treatment of workmen's compensation injuries is concerned, and the discontinuance of insurance company clinics in New York State. It will result in increased compensation and increased cost of medical service.

The second was an Occupational Disease bill making compensable after September 1, 1935, every injury resulting from any disease traceable to the occupation of the employee. Another bill, defined and limiting the compensability of silicosis, the most serious occupational disease, was passed by both branches of the legislature but vetoed by the Governor. The possible results of this act are so serious as to warrant reconsideration at a special session of the legislature.

NORTH CAROLINA: Some months ago the North Carolina Supreme Court, in a decision, interpreted the Workmen's Compensation Act as covering all occupational diseases. A bill has been enacted which defines and limits the compensability of such injuries, but to an extent that does not greatly improve the situation.

ILLINOIS: For some time past, Illinois has had the worst occupational disease situation of any state in the Union and what amounts to a racket of large proportions has resulted in many suits at common law, on account of alleged occupational disease injuries, particularly silicosis. A decision of the Supreme Court of the State, handed down in an American Mutual case on April 17, declared a major part of the Illinois Occupational Disease Act "unconstitutional." A bill has been introduced in the legislature making injuries from silicosis compensable under restrictions.

In less than a month after a section of the Illinois Occupational Diseast Act had been declared unconstitutional, the Illinois House introduced an act which, says **National Underwriters,** "seems like a model occupational disease act, modern enough for today's social ideas and fair to employers." It represents the combined efforts of the Illinois Manufacturers' Association, a considerable part of the labor interest, insurance men, and medical leaders in industrial hygiene.

The Act names 30 diseases which shall be deemed to be occupational diseases, and they are compensable without regard to fault in the employer. The compensation provided is prescribed as the sole and exclusive compensation payable on account of such diseases. A common law right of action is set up for all other diseases growing or alleged to have grown out of the claimant's employment, but the recovery is especially limited to the sums that would be payable if the disease were compensable.

In four recent common-law cases, one of which was an American Mutual case, the Illinois Supreme Court declared that Section 1 of the Illinois Occupational Disease Law, after having been on the Statute books for 20 years, is "unconstitutional." The section reads:

"That every employer of labor in this state, engaged in carrying on any work or process which may produce any illness or disease peculiar to the work or process carried on, or which subjects the employees to the danger of illness or disease incident to such work or process, to which employees are not ordinarily exposed in other lines of employment, shall, for the protection of all employees engaged in such work or process, adopt and provide reasonable and approved devices, means or methods for the prevention of such industrial or occupational diseases as are incident to such work or process."

In arriving at its decision, the Supreme Court held that the language used did not prescribe with sufficient definiteness, the intended meaning of the words: "means and methods," "reasonable," "devices," "approved," and "ordinarily."

The court further contended that any attempt on the part of an employer to comply with the provisions of this section would be a matter of guesswork, 'that its provisions are so vague, indefinite, uncertain and incomplete, that no sufficiently clear and intelligible standard of duty is defined thereby. A statute which requires the performance of an act in terms so indefinite, uncertain and puzzling that men of ordinary intelligence must necessarily guess as to its meaning and differ to its application transcends due process of law."

In the American Mutual case on

2. *Parks* v. *Libby-Owens-Ford Glass Co.*, 360 Ill. 130; *Boshuizen* v. *Thompson & Taylor Co.*, 360 Ill. 160.
3. In *Parks* v. *Libby-Owens-Ford Glass Co.*, 360 Ill. 130, at p. 137.
4. *Madison* v. *Wedron Silica Co.*, 352 Ill. 60.
5. In *Boshuizen* v. *Thompson & Taylor Co.*, 360 Ill. 160, at p. 163.
6. *Thompson* v. *United Laboratories Co.*, 221 Mass. 276; *Pigeon* v. *Fuller & Co.*, 156 Cal. 691; *Wiseman* v. *Carter White Lead Co.*, 100 Nebr. 584.
1. *American Mutual Magazine.*

which this decision was handed down, the plaintiff had been employed about a year, canning and packing pepper and other spices. She alleged that the operations she performed exposed her to irritating dusts and to illness and disease incidental to such work. In defending the case, American Mutual attorneys claimed that, among other grounds, Section 1 of the Occupational Disease Act violated, with other constitutional provisions, Article 3 and Section 2 of Article 2 of the State Constitution and the Fourteenth Amendment of the Federal Constitution.

As Section 1 of the Occupational Disease Law is of no effect, many persons who have brought suits in which the negligence of the employer has been alleged to consist of his failure to fulfill the requirements of said Section 1 are left without the right to obtain either damages or compensation benefits.

Medical

TO THE mind of every thinking physician it must occur that the new compensation law, which went into effect July 1st, is a step in advance. It is self-regulation in medicine, with an attempt to pull out by it roots "racketeering" in the practice of what has become one of medicine's important phases, the treatment of the disabled employee.[2]

Have you registered for this work? If you have failed to do so you will be unable to treat disabled workmen and collect fairly for your work done. If you have failed to register and are interested, as you must be, in the upright, ethical practice of medicine, industrial or otherwise, whether you be a general practitioner or a specialist, you silently register a voice of protest against progress in the proper care of the sick. You automatically say that you favor the old system with all its abuses, rather than this newer, more equable, open and above-board method of dealing with this phase of medical practice.

As an upstanding member of the medical profession, whether you be a member of the County Society or not, you must believe in the upright practice of our profession. Register, not for the right or the privilege of doing compensation work, but rather for the expression of your willingness to do this work uprightly.

It follows that cooperation from every angle is necessary so that you may obtain the best results from the working of this law, both from the economic as well as the purely medical point of view. Talk about it with your patients, inform them particularly concerning their rights under the law of a free choice of physicians whenever disabled. Tell them that they need not be coerced; that they have as much right to go to their family doctor, or specialist of choice for treatment for disability arising out of their work, as they do for their ordinary ailments.

The registration fee of $3.00 is necessary so that the proper clerical machinery may be set up for your protection.

Blanks may be obtained by calling in person at the County Society office or in your own hospital.

May we repeat that the committees of the Medical Society of the State of New York and the various County Societies are giving freely of a vast amount of time and energy to the study of problems, classification of applicants, development of administrative procedure and plans for future expansion.

Register, then, for general or special work in the treatment of the disabled workman, because this care takes in general as well as special procedures and methods, being really a part, or one particular phase, of the general practice of medicine.

Bill No. 20, passed by the last session of the legislature and signed by the Governor, appears to apply to the entire practice of medicine by amending the Workmen's Compensation Law in relation to occupational diseases by adding a new subdivision 28 which adds to the list and all occupational diseases in any and all employments enumerated in subdivision one, section three, of Chapter 254 of the Workmen's Compensation Law.[3]

Hot Weather Hazards

SUMMER time is danger time, and the higher the temperature the greater the danger.* Heat combined with ignorance of the basic laws of summer hygiene kills its victims every season; not only the vacationist, but also the worker and the little child or aged person in the home....

The time to start treating sunstroke is when the first symptoms appear. These are dizziness, headache and faintness. The patient should be placed in a cool, shady place and a physician summoned at once. All tight, constricting clothing should be loosened or removed. Often this is all that is necessary, and after a rest the patient can be removed to his home to be kept quiet for 24 hours.

The thermometer makes the diagnosis between heat exhaustion and hyperpyrexis or themic fever. As the treatment of these conditions, both caused by heat, is entirely different, it is of the greatest importance that the physician make the diagnosis, as the wrong treatment will not only harm the patient but may even be responsible for his death.

In heat exhaustion the patient suffers from shock (severe mental and physical depression). The skin is moist, pale and cool. The pulse is soft, and weak; the breathing fast but shallow. The patient is usually conscious and is anxious or worried and has sensations of extreme illness. The temperature is below normal. Such a person needs stimulation and needs it quickly, as all the vital nervous centers are weakened and on the point of collapse. Stimulants must be given by hypodermic needle if possible, if not, by mouth. Camphor, aromatic spirits of ammonia, and brandy are usually available.

Artificial respiration may be used to help the breathing, the same methods being used that are valuable in resuscitating a nearly drowned patient. The importance of calling a physician is understood when we realize that the patient may be undertreated or overtreated. Too much stimulation, too great effort to restore the breathing and circulation by the amateur may do more harm than good. As soon as improvement in the patient is noted, wrap him in blankets, apply hot water bags and continue stimulation by mouth. Coffee may be of benefit.

In thermic fever we find an entirely different condition. The temperature rises very rapidly and may reach 108° and in some cases even 112° just before death. The patient is burning up because heat is being formed inside the body faster than it can be liberated through the skin. The face is dry and flushed, the breathing and pulse rapid, and the patient is delirious or in deep unconsciousness. He vomits, has diarrhea, and often has convulsions. The pupils of the eyes are at first widely open and later very small.

What this patient needs is the release of the accumulated heat, and this can be done best by the use of ice. He should be immersed in a bathtub in which pieces of ice are floating.

The body and particularly the spine should be rubbed with ice. An internal bath of ice water may be of great value.

Often the temperature falls as rapidly as it has risen and when it falls to 100° the cold treatment should stop and the patient should be wrapped in blankets and stimulated with coffee or brandy. But even after that, frequent temperature observations should be made as there is always the possibility of fever recurring.

People who are camping or who have no hospital facilities should be able to determine which of the two forms of heat affliction have affected the individual. If they realize the difference between heat exhaustion and thermic fever, they will at least be able to care for the patient in an intelligent manner until medical help can be secured.

Few people realize that the ultraviolet rays of the sun which reach our bodies through a fairly clear atmosphere are capable of producing powerful chemical effects and may bring about violent reactions through sunburn. . . .

The hot weather this year has brought with it a precipitous decline from the most extensive epidemic wave of scarlet fever ever recorded in Illinois. A recent report indicates that the lowest weekly incidence exists since last October. Since June first the weekly prevalence has dropped from 1,150 to 450 cases and the outlook is that by the end of this month the incidence will have fallen to less than 100 cases per week. Pneumonia and measles likewise reached new minimum weekly levels for this year, with the promise of falling rapidly lower.

Typhoid fever jumped to the highest prevalence level of the year while whooping cough and infantile paralysis turned sharply upward.

2. *The Bulletin of the Medical Society of the County of Kings*, July, 1935. See *Industrial Medicine*, May, 1935, p. 272, for full text of the law.

3. See *Industrial Medicine*, May, 1935, p. 278, for full text.

* Radio Talk July 6, 1935, WHFC, by Dr. Claud Wm. Chamberlain, Assistant Superintendent of Social Hygiene, Division of Communicable Diseases, Illinois Department of Public Health.

Pre-Employment Examinations

I SHOULD like it understood that the paper which I propose to present reflects my own individual views,* and is not to be construed as reflecting either the policy of the Maryland Casualty Company or of the National Bureau of Casualty and Surety Underwriters.

The old Roman maxim of law, caveat emptor (let the buyer beware), has been pretty well abandoned by modern business in the buying and selling of commodities. A merchant must look well to the quality and title of his merchandise, and be fully prepared to accept responsibility for both before he can sell and hope to continue to sell. The modern buyer also insists that this responsibility be assumed by the seller, and takes full precaution to satisfy himself that this is so.

In most commerce is this true; it is not, however, usually true in the buying and selling of personal service. The employer generally is willing to purchase services upon greatly inadequate guarantees of ability to successfully and safely perform the duties of the position he seeks to fill, and not always does he offer his employee duties and a working environment that do not militate against the latter's health and safety. Likewise prospective employees do not always offer bodies capable of safely and efficiently performing the duties of the positions they seek, nor do they generally satisfy themselves that these positions will not cripple them through their own physical inadequacies, or through unsafe working conditions. . . .

The Life Extension Institute, in a series of 100,000 physical examinations of adult males in the prime of life, found 27% with defective vision uncorrected by glasses, and 13% with various degrees of impaired hearing, a total of 12% had some type of abnormality of the heart and 15% had some type of easily recognized disease of the nervous system or brain; 6% had hernia, 21.0% had frequent headaches and 8% complained of dizziness. Another study of 12,000 employees of a large manufacturing plant showed 24.5% to have blood pressures over 150, and 3.8% of these with blood pressures over 175. Aside from other individual temperamental or psychological inadequacies of motor vehicle drivers, do not figures such as this give at least a clue as to one of the causes of our highway death rate? And cannot we translate such figures into terms of manufacturing overhead as shown by accidents, costly in limb and insurance premium, in work spoilage, in labor turnover, and in numerous other items familiar to all of us? Would our great fleets of trucks and taxicabs create such hazards to life, limb and property if each driver were known to be physically fit before he took his vehicle upon the highway?

Insurance companies spend great sums of money in losses each year in excess of what is collected in premiums in their workmen's compensation business. The writing of workmen's compensation insurance is surrounded with more and more underwriting restrictions; claims are studied and settled with meticulous care and great efficiency; accident prevention programs are executed so capably and thoroughly that in spite of everything, the casualty insurance industry does in this respect alone a huge piece of public service. Still the losses continue, apparently unchecked.

There are many reasons for this, most of which are beyond the scope of this essay, and beyond the ken of this writer. The question of the pre-employment examination of the worker is one, however, which at this juncture fits well into the picture. As a preventive of accidents and of occupational disease, I can think of no more crying need today in the general situation that confronts us.

Small employers and insurance companies regard a pre-employment examination program rather timorously. The general attitude of organized labor toward the subject contributes to this point of view, as does the question of cost. The latter is inconsequential, involving as it does, the spending of $1 to save $2. Assuming for the moment a purely claim standpoint, we have shown that approximately 6% of so called normal males have herniae; 2.5% of the 7,000 compensation accidents that I have studied are herniae. Herniae are for most part congenital and can be detected before they are "aggravated" or "caused" by a strain. They cost $133 each for medical, and $137 for compensation, a not inconsiderable item, and one that is to a large extent preventable by early detection and cure. Of so called normal men 27% have been shown to have impairments of vision uncorrected. A simple foreign body in the eye of any of these men, in the absence of data to prove the defect preexistent, may cost the employer huge unwarranted sums. Examples such as these can be recited almost ad infinitum, nor merely from the angle of the claim man, but the safety engineer as well. The humanitarian, perhaps more than any other, can find food for thought in the general problem, for it is a pitiful thing to see the death and disaster that stalk in the wake of preventable industrial accidents and diseases.

The approach to any general program of pre-employment examination must be made from very high ground, overcome before a constructive out- and many grave obstacles must be come can be expected. Any endeavor that ultimately creates an industrial black-list of physically impaired persons, or which denies the opportunity to engage in gainful employment because of limited physical handicaps should properly arouse the ire of organized labor, and probably forms the basis for the antagonistic attitude toward the matter that exists at present. There is, however, a community of interest in this matter that should offer a Field of the Cloth of Gold. It should be quite as much a matter of interest to the worker that he be spared exposure to working-conditions that are detrimental to his health and bodily integrity as it is to his prospective employer. Surely no snae man regards the pittance of compensation benefits as adequate remuneration for painful or disabling injuries or diseases.

The answer to the problem is twofold; first, recognition of the fact that there is almost always a job of keeping with the capacity of the impaired individual, and using the pre-employment examination primarily as a means of fitting the man to a suitable job. Next is the matter of discovering remediable defects, pointing them out to the worker, and aiding him in securing their correction. Most of the larger employers pursue the policy of pre-employment examination with great success, ad it is likely that their recognition of these two principles contributes in large measure to that success, without causing serious protest from organized labor. It must, of course, be recognized that the larger the employer the greater his opportunity for engaging in scientific job placement, and usually the greater his vision in encouraging and assisting in the correction of remediable defects. A tremendous field of public health and public safety, that need not at all be a philanthropic gesture, but which challenges the thought of everyone, is open to industry.

The realization that the threat of occupational disease legislation has become a fact has brought the whole matter clearly within our mental focus. We have attacked the problem of occupational disease on various fronts; first through the laws, next through the claim aspects, then through the underwriting considerations. We must come to the clear understanding that the only really vulnerable point is in the prevention of occupational disease.

Let us, in considering this, regard as axiomatic that 80% of occupational disease is preventable. It is expensive to prevent, but much more costly to ignore. Prevention falls within twin categories; the mechanical and human.

It has been pretty generally accepted by employers, employees, insurance and organized labor that a proper selection of persons to be exposed to occupational disease hazards is proper and necessary. Why this should be true only with reference to occupational disease hazards and not to occupational injury hazards is not entirely clear.

It becomes our task at this time to decide how we are going to keep from dangerous contact with occupational disease hazards those persons not physically qualified to withstand them. I am going to confine my remarks to dust hazards, since to these does the question of physical selection apply most conspicuously.

Our first effort is to detect those applicants who have previously had dangerous exposure to toxic or irritating dusts, and second, those who by reason of physical impairments are not fit for exposure to them.

Our pre-employment examination may be as thorough and extensive as the employer wishes to make it; for this discussion I shall confine my re-

*From an Address by DR. ALLEN D. LAZENBY, Chief Surgeon, Maryland Casualty Co., Baltimore, Md., delivered June 20, 1935, at National Bureau of Casualty and Surety Underwriters' "Conference on Occupational Diseases," and published in *Safety Engineering*, July, 1935.

marks to those methods of value in detecting persons already suffering from silicosis or asbestosis, or peculiarly susceptible to either.

The occupational history, of course, comes first. It is upon this history that conclusions developed from the physical finding will be made later on. This history need not be taken by a doctor, but a properly instructed, tactful layman may be used. It may take 10 minutes to complete such a history. On the other hand, it may take an hour or more of the most tactful and expert questioning if an adequate story from an ignorant or unintelligent workmen is to be secured. The identification data is the first information to seek. What is his name, address, age, social status, nationality, trade? We next want to learn all of the details of every job he has ever had since he began work. We know that silicosis and asbestosis come from exposure to adequate concentrations of dust containing silica dioxide, or magnesium silicate, and the likelihood or extent of these diseases depends almost entirely upon the exposure, considering the factors of duration, concentration and size of the dust particles. So, for completeness, clarity and as an aid to memory, we begin with the year in which the applicant left school and went to work. What was his first job, and who did he work for? What kind of work did he do? How many hours a day did he work? Was it dusty? Was he protected from dust? How long did he work at this job? We then secure similar data on each consecutive job, until we come down to the we are examining him. Every year job just preceding the one for which of his industrial life should now be recorded, and we can submit to the examining physician a complete picture of past exposure for correlation with the physical findings that will later be made, and have a record that may prove valuable if litigation later arises. The statement should, of course, be signed and witnessed.

The applicant next reports to the examining physician. The medical examination may be as thorough as the employer wishes to make it, but for the ascertainment of fit subjects minimal. First a medical history should be taken. What if any exposure to tuberculosis or other lung for exposure to dust the following is disease has the applicant suffered in his home and through his family? We know that silica dioxide dust does not deal kindly with tuberculosis, past or present, and when an applicant has been exposed to that disease, we must be on our guard. What diseases of the respiratory tract, such as influenza, pleurisy, pneumonia, tuberculosis or frequent colds has he had, and how often? Perhaps one of these diseases may have been tuberculosis in disguise, or perhaps frequent respiratory ailments may suggest a fundamental weakness in the air passages that would make exposure to dust extremely dangerous.

Is our applicant in good health now? If not, what is the trouble? Is he short of breath on exertion? Show us how good your wind is by jumping up on this chair 10 times. How does the general appearance of the applicant impress the examiner? Is he healthy looking, well nourished, and of good complexion, or is he sallow or sickly in appearance? What is his height in shoes and his weight? Has he gained or lost weight in the past year? In either event, to what does he attribute the loss or gain? Rapid loss of weight suggests tuberculosis or some other organic disease, and it is well that the examiner be on guard.

Next we measure the applicant's chest in inspiration and expiration, and also the abdomen. The degree of mobility of the chest is useful in determining lung capacity, and since limitation of mobility of the chest is a determining symptom of silicosis or asbestosis, this data will provide us with useful clues. Limitation in chest mobility may also be suggestive of an obstruction in the normal air passages. The circumference of the abdomen, taken in relation to the size of the chest, is useful in expressing weight distribution.

With the man stripped to the waist, the heart should now be thoroughly examined as to its rate, size and organic integrity. A disease of the heart is an outstanding factor in susceptibility to dust disease of the lungs. The elimination of a certain amount of inhaled dust and the general reaction of the lungs toward dust is governed to a considerable extent by the efficiency of the circulation of blood through them, and it is important that a worker indust have a sound circulatory apparatus.

The lungs are now carefully examined. Unfortunately mere physical examination is not sufficient to always detect silicosis or asbestosis. These diseases may and usually do present abnormal sounds to the examiner's ear, but the sounds are not constant nor characteristic and alone are not ample to justify a diagnosis, except in exceptional cases. This examination of the lungs, may, however, produce other significant data. It may show definitely present or past tuberculosis, an old pleurisy, acute or chronic bronchitis, bronchial asthma or a host of other respiratory diseases, any of which might make it highly undesirable to recommend the applicant for employment.

At this juncture, it is well to take stock of the material which has now been collected, and to decide whether or not our applicant has so far qualified. It may be that we have enough knowledge as to his physical state to declare him unfit for employment without the added expense of an x-ray study.

It is my opinion that employment should be postponed in any applicant giving a history of influenza during the last three months, of pneumonia within one year, or any acute disease of the lungs or air passages found on examination for an appropriate period.

I also believe that employment in a dusty trade should be denied persons showing by history and on physical examination, without undergoing x-ray study, any of the following:

1—Pleurisy, tuberculosis, past or present, or any chronic disease of the lungs such as bronchial asthma, chronic bronchitis, bronchiectasis.

2—Frequent colds if accompanied by a history of sinus complications or septic tonsils.

3—Syphilis by name or symptom, chronic kidney disease if accompanied by blood pressure changes, and any chronic disease that might lower the resistance of the body.

4—A chest expansion of less than 1½ inches, or where the abdomen is two inches or more larger than the chest at rest.

5—Any diseases of the heart, regardless of the degree of compensation or nature of the disease.

If our applicant has measured up to our standards so far, he should be given the acid test of x-ray study. It is not necessary or proper for us here to discuss the details of x-ray technique or interpretation. We might suggest, however, that x-ray studies adequate for a proper chest diagnosis must be taken with a careful technique, and interpreted by a roentgenologist of ability and experience. It is not a task for a novice, but one for an expert in every sense.

Following x-ray of the chest, the applicant should be declared unfit for exposure to dust if any x-ray pathology of a chronic nature, such as active, quiescent or arrested tuberculosis, chronic bronchitis, bronchiectasis, cancer of the lung, syphilis of the lung, etc., and for any x-ray pathology of dust greater than that of increased root shadows, as shown in the classification of x-ray changes found in silicosis as prepared by a committee composed of Drs. Sayers, Pancoast, Pendergrass, Lanza, McConnell, Riddell, Sampson and Gardner. This classification is to be released in publication at an early date.

Gardner feels that an applicant over 25 years of age with evidence of a healed primary tuberculosis process, representing a healed childhood infection, would be suitable for exposure to dust. Without doubt Gardner is correct in his views.

Infection Prevention

INFECTIONS following injuries are too frequent.* They occur in more than 5% of our compensation cases; but in most instances they are preventable, as I have found that in only one out of every 25 cases of infection was the patient treated by a doctor on the day the accident occurred. This means that 96% of the infections occur where there has been delay in medical treatment.

Before discussing the cause of delayed medical treatment, let us consider the cost of infections as affecting both the employer and the injured employee. The average medical cost in all cases is $13.49 per case; but where there is infection present the average cost is $24—an increase of 78%. The average disability in all cases is nine days; but where there are infections the average is 11½ days —an increase of 40%. I have with me

*From an Address by J. C. Root, Chief Claims Examiner, North Carolina Industrial Commission, before the Annual Statewide Industrial Conference; published in *Safety Engineering*, July, 1935.

a chart showing an analysis of infections reported over a period of 14 days—not consecutive days—but 14 days taken from a total period of nearly a month. It may safely be accepted as a cross-section to be applied to the whole of a year's experience. When applied ,to last year's experience we find that during the year there were 1440 cases of infection. The increased medical cost of $10.57 per case amounted to $15,220. The increased disability added $25,-614 to the amount of compensation paid. So that in these cases $40,834 was paid in excess of the average for all cases. Extended disability prolonged the period during which the injured employees were losing 40% of their wages, and the wage loss was thereby increased $7,440. This sum does not fully represent the increased loss to the employees, as, in consequence of infection, there were many instances where perfect recovery was not realized. Sooner or later these permanent disabilities will mean reduced earning power for life—ending in poverty for some. So, when all is considered, the cost of infections is high—too high not to demand attention. There is room for improvement. But I would not deprecate the wonderful results which have been obtained through the cooperation of employers and employees with the Industrial Commission in its campaign for education in first-aid. Only a few years ago over 10½% of the compensable cases in New York were complicated by infections—more than double our average for last year. In the same year the average disability in New York in cases of infection was 42½ weeks—25 times the average in North Carolina last year. In studying these comparative figures allowance must be made for possible differences in the compiling of statistics, as we have not in our figures included estimates for lost time in fatal cases. It is obvious, nevertheless, that after making all reasonable allowances ours is by far the better record. . . .

I am aware that the first objective of a safety program is the prevention of accidents. I am persuaded that a well rounded safety program will not overlook the proper care of those who are the unfortunate victims of accidents to the end that infections with their unnecessary losses to employers and employees may be prevented. I wonder if in the enthusiasm for the prevention of accidents, the immediate treatment of injuries has not been too much neglected. And I wonder if either the management or those who are injured are altogether blameless. I fear that the zeal for a "no-accident" record, and the hope of a new "low" medical cost sometimes induce employees not to promptly report all minor injuries. Such practice is bound to be productive of infections, converting minor injuries into serious ones. It is like saving at the spigot to let flow at the bung. The figures I presented a moment ago are most convincing in this respect. . . .

There is a definite place for first aid treatment at the plant.

But there are many cases where

THE BULLETIN

of

The American Association of Industrial Physicians and Surgeons

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

VOLNEY S. CHENEY, M.D.
Secretary-Treasurer, Chicago

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such treatment alone is not sufficient and can not even in the beginning take the place of the doctor's services. Thorough cleaning of the wound through the use of soap and water and first-aid antiseptic application can be given by laymen. In some instances the plant's first aid facilities are indiscriminately relied upon as the only treatment for minor injuries, and consequently many cases are infected when first seen by the doctor. Such a procedure is not fair to the doctor, and is expensive for everybody concerned. I am not prepared to say that in every case the injured man should be sent to the doctor immediately after first aid at the plant, though I doubt not that if the best results are to be obtained and at the least cost more cases should be handled in this manner. Surely, medical treatment should be given before the symptoms of an active infection appear. The first aid treatment should not end with the initial dressings, but the injured should be required to report back to the first aid attendant for a check-up. Your doctor will tell you that such a practice is **safe** practice. The check-up is a part of his own technique.

But the most frequent cause of infection is the employee's delay in reporting a minor injury—such as a scratch, small cut, bruise or torn nail. An employee who in such a case does nothing about his injury or relies upon tobacco juice or kerosene as an antiseptic, or his handkerchief, a piece of waste or a part of his shirt for a bandage, has little appreciation for his own life or his responsibility to his family. Employees should be taught that every injury, however slight, which breaks the skin is a **potential infection.**

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Effects Of Breathing Dusts With Special Reference To Silicosis

—Review of the Literature—

By D. Harrington
Chief, Health and Safety Branch, U. S. Bureau of Mines,
and
Sara J. Davenport
Principal Translator, U. S. Bureau of Mines

NOTE: "U. S. Bureau of Mines Information Circular 6840" (May, 1935) is entitled "Review of Literature on Effects of Breathing Dusts, with Special Reference to Silicosis." The contents are as follows:

CONTENTS: Prevention of dust diseases.
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This circular follows I. C. 6835, issued in March, 1935, a portion of which, relating particularly to silicosis, was previously published herein.*

The current circular presents Part II-A and deals with the principal factors producing pulmonary pathology and methods of determination of dust in air.

Part II-B will contain data on the engineering and medical control of dust diseases.

We include in this issue the part of Section 1 which ends with "Properties of sericite." The remainder of Section 1, together with Section 2, will follow in our August and September issues.

*Industrial Medicine, April, 1935, pp. 210-221.

Prevention of Dust Diseases

AS NO cure is known for silicosis after it has developed, prevention is the only effective remedy. There are two main lines of approach to the problem of dust-disease prevention in industry—the engineering, through control of dust production, and the medical, through selection of workers by examination; success probably depends upon a combination of the two.

Hatch[1] considers the following measures essential to a complete, well-balanced program of control of the dust hazard in industry:

1. Selection of workers by means of physical examinations in order especially to eliminate those with tuberculosis and other disorders of the respiratory system.

2. Reduction of the dust concentration below the standard of permissible dustiness through adequate means of dust control and good housekeeping.

3. Limiting the frequency and duration of employment in the dusty occupations, thus reducing the rate of deposition of dust in the lungs.

4. Routine measurement of the effectiveness of the dust-control program by means of periodic medical examinations and dust surveys.

Of these. reduction in dustiness is the most direct in its effect and is fundamental to any program of control. Hatch[1] emphasizes, however, that present-day standards of safety are only estimated values, and reduction in dust exposure below the estimated threshold value does not give absolute assurance of complete control of the disease. Moreover, a potential hazard always exists in basically dusty industries, and a constant guard therefore must be maintained. Workers should be selected by physical examination to insure maximum resistance against the action of dust in the lungs. The employment of workers already injured by previous dust exposure thus would be largely eliminated. Routine determination of dust concentrations provides a measure of operation of the dust-control system, but the efficacy of the control program must be measured by periodic medical examination, since only by this means can the presence or absence of silicosis be determined. An inadequate control program thus can be strengthened in time to arrest the widespread development of the disease.

Section 1. Principal Dust Factors Producing Pulmonary Pathology.

THE principal factors now thought to determine whether exposure to dust will produce pulmonary pathology are nature of the dust, particle size, quantity of the dust dispersed in the atmosphere, and length of exposure. In general, it has been held

that, other factors being equal, the harmfulness of a quartz-containing dust is in direct proportion to its quartz content. Apparently, then, it is important to ascertain the exact mineralogical composition of any dust under investigation.

Every mineral possesses certain characteristic properties that separate it from other minerals of similar appearance when viewed under the polarizing microscope. These diagnostic characteristics are supposed to persist even to the grains of smallest size; with patience, therefore, the percentage of the various mineral constituents of a dust can be determined[2].

Silica Dust: Free silica or quartz has been considered the outstanding dust factor in industries with excessive mortality from dust diseases. The following summary of information on the chemical properties, occurrence, and industrial uses of silica is taken from "A Review of Silicosis," by Adelaide Ross Smith[3].

Chemical properties of silica: Silica has the chemical formula SiO_2, indicating that it is a combination of the element silicon (Si) and oxygen (O). It occurs alone in the "free" form and, as such, is variously known as silicon dioxide or "free" silica. In combination with other elements it is known as "combined silica," but this report is concerned with free silica especially because in this form it causes more damage to the lungs than when it is in the combined state.

Free silica (silicon dioxide) may be either crystalline or noncrystalline (amorphous) in structure. Crystalline silica, which is usually quartz, is a white or colorless, extremely hard substance ordinarily with a specific gravity of 2.66. When heated for a long time at about 1,000° C. it forms a second variety known as "tridymite" with a specific gravity of 2.33; a third variety, cristobalite (specific gravity 2.34), occurs when quartz is heated for periods not long enough to form tridymite. Noncrystalline (amorphous) silica occurs as a fine white powder.

Silica assumes the vitreous, molten form more easily than any other mineral substance, melting to colorless quartz glass in the oxyhydrogen blowpipe at about 1,600°. The coefficient of thermal expansion of quartz glass is very small, so that it possesses in a high degree the property of being able to withstand rapid cooling without cracking.

Silica is chemically inactive at ordinary temperatures but at high temperatures acts as an acid anhydride and combines with the bases and many metallic oxides to form silicates. When soluble alkaline silicates are treated with acids silica acid, an amorphous gelatinous substance, is obtained. This is soluble in water and acids and is readily dissolved by dilute solutions of alkali hydroxides and carbonates.

Occurrence of silica in nature: Silica is one of the most common minerals. In one form or another it constitutes approximately 60% of the earth's crust and forms whole mountain ranges in certain countries.

Examples of free silica in the pure crystalline form are quartz and rock crystal, but many other minerals whose essential composition is quartz have been changed in color or form by the addition of small amounts of other substances, usually oxides of other elements. Many of these are used chiefly for ornaments and jewelry; but some, such as buhrstone and flint, have important industrial uses as well. These quartz rocks include the following: agate, aventurine, amethyst, bloodstone, brazilian pebble, buhrstone, carnelian, cat's-eye, chalcedony, chert, cairngorm, chrysoprase, certine, flint hairstone, hyalite, jasper, jaspilite, lydian stone, milk quartz, needlestone, onyx, opal, plasma, phrase, rose quartz, sard, smoky quartz, and tiger's-eye. Common rocks containing a high proportion of free silica are: sandstone, essentially grains of quartz with some feldspar, mica, and other materials added; quartzite, a product of sandstone; ganister, a sedimentary rock with a very high percentage (about 98%) of free silica; granite, composed essentially of quartz and feldspar, containing 25 to 35% of free silica; and pegmatite, a form of granite. Ordinary sand is almost entirely quartz.

Amorphous (noncrystalline free) silica forms opal and is associated with quartz in certain other stones, such as chert, flint, and chalcedony. It is represented chiefly by diatomaceous earth and tripoli or rottenstone.

Diatomaceous earth is a soft, earthy rock composed of the skeletons of small aquatic plants resembling chalk in appearance. It can hold four times its weight of water and is a poor conductor of heat, sound, and electricity. Tripoli is a porous rock which results from the natural decomposition of sandstone.

Combined silica (silicates) occurs in almost every rock species and forms the essential substance of such common materials as clay, mica, feldspar, and slate.

Industrial uses of silica: Silica has many properties of industrial value: hardness; resistance to solution (even in acid), heat (under some conditions), and temperature changes; and crystalline and decorative properties. In the amorphous form it is also valuable as a filtering medium and nonconductor.

It is used in a variety of different forms, in the massive form both roughly broken and cut to different sizes and shapes; in the original condition as pebbles or as grains; crushed to a coarsely granular form or ground to a fine powder. Its chief uses and corresponding forms have been tabulated by Smith[3] from Ladoo as follows:

Abrasive uses, in scouring and polishing soaps and powders—quartz, quartzite, flint, chert, sandstone, sand, tripoli, and diatomaceous earth, all in finely ground state; in sandpaper—quartz, quartzite, flint, sandstone, and sand, coarsely ground and closely sized; in sand-blast work — quartz, quartsite, sandstone, and sand, crushed into sharp angular grains uniform in size; metal buffing, burnishing, and polishing — ground tripoli and other forms of ground silica; for sawing and polishing granite—sharp, clean sand graded into various sizes; as whetstones, grindstones, buhrstones, pulpstones, oilstones — massive sandstone from very fine — to moderately coarse-grained; tube-mill lining — chert, flint, and quartzite in dense, solid blocks; lithographers' graining sand —medium to fine sand or rather coarsely ground silica and tripoli; tube-mill grinding pebbles—rounded flint pebbles; in tooth powder and paste—various forms of pure silica finely ground; wood polishing and finishing—all forms of silica ground to medium fineness. Refractory uses, in making silica fire brick and other refractories — fairly pure quartzite known as ganister, not less than 97% SiO_2 nor more than 0.40% alkalies, tightly interlocking grains desired. Metallurgical uses, in making silicon, ferrosilicon, and silicon alloys of other metals, as copper—moderately pure sand, massive crystalline quartz, sandstone, quartzite, or chert; as a flux in smelting basic ores—massive quartz and quartzite; foundry-mold wash—ground sandstone, quartz, and tripoli; foundry parting sand—fine sand and ground tripoli. Chemical industries, as a lining for acid towers—massive quartz or quartzite; as a filtering medium—massive diatomaceous earth and tripoli, sand, finely granular quartz or quartzite, finely ground tripoli, and other forms of silica. In the manufacture of sodium silicate — pure pulverized quartz sand, pure tripoli, and diatomaceous earth. In the manufacture of carborundum—pure quartz sand. Paint, as an inert extender—finely ground crystalline quartz, quartzite, and flint, also finely ground sandstone, sand, and tripoli. Mineral fillers, as a wood filler—finely ground crystalline quartz, quartzite, flint tripoli, and other types of ground silica. In fertilizers and insecticides—finely ground crystalline quartz, quartzite, flint, tripoli, and other types of ground silica. As a filler in rubber, hard-rubber pressed and molded goods, phonograph records—finely ground silica of all types. In road asphalt surfacing mixtures—finely ground silica of all types. Ceramic uses, in the pottery industry as an ingredient of bodies and glazes, flint, tripoli, and chert (amorphous silica preferred), also all other forms of very pure silica, all finely ground. Building stone — cut granite and sandstone. Monuments, paving blocks —cut granite. In the manufacture of ordinary glass—pure quartz sand; in the manufacture of fused-quartz chemical apparatus, as tubes, crucibles and dishes—very pure massive quartz preferred. Decorative materials, in the manufacture of gems, crystal balls, table tops, vases, statues—rock crystal, amethyst, rose quartz, citrine quartz, smoky quartz, chrysoprase, agate, chalcedony, opal, onxy, sardonyx, jasper. Insulation, heat insulation for pipes, boilers, furnaces, kilns — massive and ground diatomaceous earth; sound insulation in walls, between floors—massive and ground diatomaceous earth. Structural material, sand-lime brick—moderately pure, sharp, angular sand, preferably finer than 20-mesh, together with a small percentage of finely pulverized silica, optical quartz, for the manufacture of lenses and accessories for optical apparatus—clear, colorless, flawless rock crystal or massive crystallized quartz.

Sericite: In 1926 Mavrogordato[4] remarked that "the increasing use of

the term 'silicosis' implies the recognition that in industry this disease is particularly related to inhalation of dust of free silica (SiO_2); in fact it is doubtful if it occurs apart from free silica, or, anyhow, the intractable silicates, for example, sericite."

The mention of sericite by Mavrogordato is interesting in connection with the relatively recent statement by Jones[5] that sericite, not silica, causes silicosis. He explains the circumstances which caused him to reach this conclusion:

"During the last 20 months I have had occasion to visit a number of collieries in the anthracite district of the South Wales coal field with the object of collecting, from the former working places of underground employees who had contracted silicosis in the course of their employment, samples of rock which could be proved to come under the category of 'silica rock' as defined in English law, for the purpose of compensation under the Silicosis Schemes. It should be explained here that, whereas under your (South African) mining law an employee who is certified as having contracted silicosis in the course of his employment in your gold mines, receives compensation without further legal proceedings, English law, on the other hand, demands proof, in the case of underground workmen in collieries, that the employee has been working in 'silica rock,' that is, in quartz, quartzite, sandstone, gritstone, or chert. In the majority of cases I was able to find samples of rock that fulfilled the legal definition of 'silica rock,' but in some, even when postmortem examination had revealed silicosis and where the former working places of the deceased were accessible, it was not possible to find rock of the type included in the Silicosis Scheme. These cases, and there were several of them, naturally aroused my interest, for they appeared to make clear the possibility that rocks other than those included in the Silicosis Scheme could give rise to dangerous dusts. I decided to investigate the matter."

Jones[6] summarized the results of his investigation as follows:

"The result of these investigations on the mineral residues obtained from 29 silicotic lungs and of the examination of the rocks and materials which gave rise to the inhaled dusts causing these cases of silicosis lead to the following conclusions:

1. The bulk of the mineral residues obtained from every silicotic lung investigated by the author consists of minute fibers of the mineral sericite, a hydrated silicate of aluminum and potassium known also as 'secondary' white mica.' This mineral is abundantly present also in all the rocks and materials which gave rise to the inhaled dust, and it is present in these rocks and material in minute fibers and scales of the size it is found in the residues and also in the lung tissue.

2. Silica in the uncombined state, as quartz, is also present in these residues as relatively coarse and fine grains; it occurs, however, in amounts subordinate to sericite. Especially is this so with regard to the small number of quartz particles, as compared with the countless fibers of sericite.

3. One relatively large grain of quartz. measuring 10 by 8 by 5 microns, such as is found in the residues, is equal in volume to 800 fibers of sericite measuring 2 by 0.5 by 0.5 microns and contributes as much silica in the chemical analysis of a residue as would 16,000 fibers of sericite. This would appear to be out of all proportion to the silicotic effect of one such quartz grain in the bronchi and bronchioles, compared with the effect in the alveoli of hundreds of fibers of sericite.

4. Silica in the uncombined state, as quartz, is not the chief cause of silicosis in these and certain other cases. This appears to be conclusively established, it is submitted here, by the following facts: (a) The amount of quartz and the size and form of the quartz grains in the sandstones occurring in the underground working places in the Scottish coal fields and in the South Wales coal fields are alike. The latter sandstones give rise to dust that has caused scores of cases of silicosis, whereas no authenticated case of silicosis has been produced in the Scottish coal fields. (b) The gold-bearing quartz conglomerate of South Africa gives rise to dust that has caused thousands of cases of silicosis; the gold-bearing quartz rock of the Kolar gold field, India, contains more quartz than the South African rock and yet produces dust that has caused no case of that disease. (c) No quartz-bearing rocks investigated by the author are known to have given rise to silicosis-producing dust except those which also contain abundance of fibrous aggregates of sercite or of fibrous silicate minerals, loosely held together and easily freed into the atmosphere when the rock is drilled and blasted. (d) Rocks which contain a relatively small percentage of quartz (well below the minimum amount in the rock types named in the Silicosis Schemes under English law), but which do contain fibrous silicate minerals such as sericite and sillimanite—as, for example, at Broken Hill mines, New South Wales—produce dust that has caused a large number of silicosis cases.

5. These investigations are not concerned with the pathological condition produced by the minerals in the lungs. Whether they merely act as mechanical irritants causing the growth of fibrous tissue, as advocated by some well-known authorities, or induce chemical changes, as maintained by certain eminent pathologists, is a question entirely beyond the province of the author. His conclusions do not militate against either theory; on the contrary, they provide the former school with evidence of the presence in the lungs of thousands of acicular fibers that presumably could act as mechanical irritants and the latter school with evidence of the presence of silicate minerals less stable than quartz and which, because of their physical form, expose far greater surface to volume for any chemical action than do the more compact grains of quartz.

6. Lastly, it is submitted that it is mainly the presence in the exploited rocks and materials of fibrous minerals, be they sericite, sillimanite, tremolite, etc. (or a fibrous form of free silica in chert, or of a fibrous rock as in pumice), in aggregates which, during the impact of drilling, blasting, or crushing, become freed into the atmosphere as individual fibers, that enables sufficient material in course of time to enter the lungs to cause silicosis. It is not suggested that sufficient minute particles of quartz could not, under any circumstances whatever, enter the lungs to cause silicosis, although the cases hitherto investigated appear to show conclusively that they have not done so; but it is maintained that the fibrous minerals hasten the process so very considerbly that their presence in the exploited rocks and materials is of far greater importance in causing this disease than is the presence of quartz."

The statement by Jones that sericite rather than silica dust is the cause of silicosis aroused considerable discussion among those interested in the question. In September, 1933, Jones[7] presented a paper before the Chemical, Metallurgical and Mining Society of South Africa, in which he said:

"I submit, therefore, that the mineral residues I obtained from silicotic lungs (and this applies to all those I have so far investigated) show definitely that it is not quartz, or any kind of free silica, that forms the bulk of these residues; and I suggest that silicosis is not mainly due to free silica, as has hitherto been accepted, but to silicate minerals occurring in the form of minute fibers loosely held together in the rocks so that, during handling, drilling, and blasting, they are readily freed into the atmosphere and inhaled into the lungs . . .

"It is clear, therefore, that hitherto no acceptable explanation has been given why the inhaled dust of your South Africa quartz-bearing rock is so extremely dangerous in its silicotic effect and why the dust of the Indian rock, with still more quartz, has not caused a single case of silicosis. The real explanation I submit, is simple: Where as in the South African rock there are, between the quartz pebbles and quartz grains, aggregates of minute acicular fibers of sericite, hundreds of which fibers can be seen in microscope sections of this rock, such acicular fibers are absent from the Kolar quartz rock or very rare. The quartz grains in the Kolar rock are interlocking: there is no fibrous mineral to be seen between the sharp boundaries of the individual grains. Between the quartz pebbles and the quartz grains in the 'banket,' acicular crystals of sericite are very abundant; in fact, sericite ranks next to quartz as the most common mineral in your gold-bearing quartz conglomerate. It is not suggested here that all the sericite present is in fibrous form; much of it is in the form of minute scales, but the point is that countless fibers of this mineral do occur throughout this rock. . .

"There is one other outstanding case which will be referred to here because it has features of peculiar interest; it is that of the Broken Hill mines, New South Wales, Australia. Many cases of silicosis have been diagnosed amongst the Broken Hill miners where 'in eight years 160 mine workers were withdrawn as suffering from simple silicosis' and where in a similar period 'of 101 men classi-

fied as suffering from silicosis plus tuberculosis there were living only 15. 86% had died.' The amount of free silica in the Broken Hill ore (and the ore bodies, be it noted, are very wide) varies from 1.62 to 17.73%; and in the 'country rock' it averages under 20% free silica. In some of the mining blocks at Broken Hill, where cases of silicosis have occurred, there is no rock which could be included under any of the types of rock named in the Silicosis Schemes in English law, yet dust has been produced that, as stated, has given rise to scores of cases of this disease; that in itself is a fact full of significance. At Broken Hill, however, occurs a rock known as 'sillimanite gneiss,' in which the aluminium silicate mineral, sillimanite, occurs sometimes in large crystals but generally as minute fibers; in fact the alternative mineralogical name of sillimanite is 'fibrolite' because it so commonly occurs in fibrous form. Sericite is also abundantly present in some of the Broken Hill rocks. Here then we have rocks low in their content of free silica, but containing fibers of sericite and sillimanite, which produce dangerous dusts.

"Attention was drawn to the low content of free silica in the Broken Hill ore and adjacent rocks by Dr. R. R. Sayers in 1925 and by Drs. Charles Badham and W. E. George of New South Wales at the International Conference in 1930. It is of particular interest to note also that at the Conference the possibility that silicates may have played a role in the causation of silicosis was not entirely overlooked although it seems clear from the definition accepted at the final sittings (that the disease was caused by silica in the uncombined state) that their effect was underestimated. Dr. E. L. Middleton pointed out that 'silicates would, sooner or later, have to be studied systematically as the cause of pulmonary disease in industry. There is abundant evidence already that the silicates cannot be regarded as a single group showing a uniform effect on the pulmonary tissues and producing the same results of disablement and death, of those affected.' Dr. Badham, also at the Conference, stated that 'he was by no means convinced that the silica was the whole story of their disease. He found confirmation of that view in the fact that where they had, as in Broken Hill, 85% of silicates, most of them intractable, they found in the lung after death intractable and other silicates. It was therefore reasonable to assume that silicates had a considerable effect on the production of fibrous pneumonoconiosis.'

"Brief reference will now be made to the clays used in the manufacture of pottery. The 'clay body', consisting largely of kaolin (china clay) formed from the decomposition of feldspar, contains fibers of sericite.... These readily become freed into the atmosphere from the dried clay."

In discussing the above paper Irvine said that the fact that this very important contribution to the subject had been so long delayed was a forcible illustration of the sometimes unfortunate results of the division of science into more or less independent special professional departments—the division was necessary but apt to be to some extent harmful, as the mineralogists, chemists, mining engineers, pathologists, and other medical men, in general, know very little about each other's business. He then summarized the history of the silicosis question from this aspect:

"When, 30 years ago, interest was awakened or re-awakened in the problem of 'miners' phthisis' by the recognition of its prevalence on the Rand, in Cornwall, in Australia, and elsewhere, it was looked upon in this country as purely an affair of gold mining on the Rand. And when we were told by the mineralogists and the chemists that the Rand banket was composed of 80 to 90% of free silica and the remainder, of silicates, pyrites, and small quantities of other minerals, we were satisfied with this account, because it was at that time accepted all over the world that free silica was the agent wholly or mainly incriminated. Not only so, but it was also accepted that the gold mines of the Rand were the only significant producers of silicosis in South Africa. I am not aware that any petrologist until now has ever questioned the free-silica hypothesis or has seriously contributed to an exact solution of the undoubted difficulties which that hypothesis was later on found to present. Probably they may say that they were not asked; if so, the more was the pity on both sides. In any case the free-silica tradition held unquestioned sway for many years all the world over.

"When Dr. Pitchford and R. Moir, in 1916, published their paper on the mineral content of silicotic lungs they were perfectly well aware that both the banket and silicotic lungs contained sericite. But, probably under the influence of the silica tradition, they appear to have underestimated the proportion of sericite in the lungs, and they overlooked the possible pathological importance of its presence.

"Then there followed a middle period during which, with a more extensive knowledge of silicosis-producing industries, certain difficulties in the free-silica tradition became increasingly apparent. Why was it that certain rocks which had a high free-silica content did not appear to produce silicosis, while others with a much lower silica content did so? The first answer suggested to that question was that associated in particular with the honored name of Dr. J. S. Haldane, namely, that the apparently innocuous rocks contained other constituents which were in some way antidotal to the action of silica. Then there came further obstinate questionings. 'Was silica after all the whole story of the disease?' Was it not 'reasonable to assume that silicates had a considerable effect in the production of fibrous pneumonoconiosis?' The Australian delegates to the Silicosis Conference in 1930, in particular (and notably Dr. Badham), voiced this suggestion. The radiographs of cases of silicosis from Broken Hill in Australia could be matched point by point with radiographs of Rand silicosis. Yet the silica content of Broken Hill ore is decidedly low and in parts extremely low. This made one think, but, as the journalists would put it, apparently we did not at the Conference think quite 'furiously' enough. Journalists, I notice, always think 'furiously.'

"And now with Dr. Jones comes apparently a third period. He has supplied at long last and for the first time an exact, direct, and extensive petrological attack upon the problem, and his results appear to show that we may have to turn the problem right around in order rightly to understand it. It is not the presence of 'antidotal' substances along with silica in the innocuous siliceous rocks, but the presence of fibrous mineral silicates such as sericite and sillimanite in the harmful rocks, which is, on his hypothesis, the solution of the puzzle, while the actual proportion of free silica present is of relatively lesser importance. Apart from the very strong direct evidence which Dr. Jones adduces, a considerable degree of prima facie support for his

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view is obtained from the fact that asbestos, also a fibrous silicate, is known producer of a pulmonary disease analagous to but not quite identical with silicosis."

Irvine was not sure whether anyone had proved conclusively that a true noninfective silicosis had been produced experimentally by inhalation of pure quartz dust, nor did he know whether sericite could readily be separated mechanically from its admixtures with quartz and other minerals. Mavrogordato[9] said that when he started working on this subject in Dr. Haldane's laboratory he used finely ground pure silica to produce a perfectly good silicosis in animals. He was particularly interested in Jones' hypothesis that the ordinary processes of rock-breaking and handling yielded only a small proportion of quartz particles of phthisis-producing size; this might account for the fact that he (Mavrogordato) produced silicosis in animals with finely powdered quartz artificially prepared. It was not suggested by Jones[10] that sufficient minute particles of quartz could not, under any circumstances whatever, enter the lungs to cause silicosis, although the cases investigated appeared to show conclusively that they had not done so; but it was maintained that the fibrous minerals hastened the process so very considerably that their presence in the exploited rocks and materials was of far greater importance in causing the disease than the presence of quartz.

Mitchell[11] questioned Jones' statement that dust from rocks that contained no sericite had never caused silicosis and quoted from the literature cases in which exposure to silica dust that contained no sericite or only a small amount had caused the disease. One industry, in which the dust contained 96% SiO_2 and only 4% alumina potash, had an annual mortality of 7.71 per 1,000 from phthisis and pulmonary fibrosis; the material used in this industry, Mitchell said, apparently was of the very type which Jones claimed had not caused a singie authenticated case of silicosis. Mitchell also made the following statement regarding the examination of biscuit placers and fettlers in the pottery industry, as reported in the literature:

"As far as I have been able to determine, the fettlers work with a mixture of clays, china clay, feldspar, etc., material which is, to a very great extent, made up of the hydrated silicate of aluminum.

"Dr. Jones, in fact, states that in china clay fibers of sericite are numerous and that they readily become freed into the atmosphere from dried clay.

The biscuit placers, on the other hand, work with a very finely ground flint, that is, with material which is almost pure silica (98% SiO_2 in an extremely fine crystalline condition).

"Dr. Jones has submitted that silicate and not silica is the main cause of silicosis and I find it difficult to reconcile this submission to the fact that silicosis is very prevalent amongst the biscuit placers, who work in an atmosphere containing much less silicate and far more silica than the atmosphere breathed by fettlers.

"If silicates and not silica were the main cause of silicosis, then why the apparent immunity of the fettlers from the disease?

"I understand that one of the silicotic lungs examined by Dr. Jones was that of a china biscuit placer and I presume that, in that case, as in all others, he found a very high percentage of silicates. A chemical analysis of the air in that process shows a low percentage of alumina and potash and a high percentage of silica. This, together with the fact that the material worked with is almost pure silica, naturally causes one to wonder as to the source of silicates he found in the lung. I have no doubt that Dr. Jones, in a very simple manner, will be able to explain the apparent anomalies to which I have referred."

Flugge-de Smidt[12] emphasized the importance to engineers of Dr. Jones' discoveries as follows:

"Dr. Orenstein, in proposing a vote of thanks, did not seem to realize the practical importance of Dr. Jones' discoveries. Except in the matter of the elimination of the unfit, the medical fraternity cannot claim very much credit for the reduction of the incidence of phthisis. It is the mining engineer who, mainly through increased ventilation, has been responsible for the betterment of our conditions and to the mining engineer Dr. Jones' investigations are of the greatest practical importance in the problems of dust determination and dust prevention."

According to Ranson[13], the results of Dr. Jones' investigation on the causation of silicosis have clarified the anomaly of certain ore bodies carrying a high percentage of quartz having no apparent deleterious effect on the worker and a deposit with a similar quartz or silica content readily producing silicosis. He said:

"Dr. Jones in his investigation adopted new and original methods, and it has to be admitted that in advancing the theory that sericite crystals or fibers are the principal cause of miners' phthisis or silicosis he has put up a very convincing case. At the same time it is difficult to imagine that such a phenomenon was not generally recognized, when one considers the renowned workers and investigators we are fortunate in having here who have spent many years in thoroughly examining every phase of the subject.

"The presence of silicates in the Rand banket is generally well-known and I believe it is also recognized that the percentage tends to increase steadily from west to east along the reef. It has been the general belief that such dust particles played no part in the development of silicosis and that minute particles of free silica were the primary cause of the disease.

"The findings of Dr. Jones may not be generally and immediately accepted as conclusive, but they have opened up additional avenues of research which may lead to finality in determining the principal cause of miners' phthisis on the Rand."

Stokes[14] wondered, as did Flugge-de Smidt, whether Orenstein had been adequate in his appreciation when proposing a vote of thanks to Jones. According to Orenstein, Jones had added one more stone to the structure upon which the efforts against phthisis had been built. Stokes suggested that in addition to giving them that extra stone Jones, first of all, had had to demolish a wood and iron structure of scientific fallacy — the free-silica fallacy — which had been accepted for 40 years.

Truter[15] introduced another point of discussion:

"The sericites or free silica are, we believe, the primary cause of silicosis. I have examined miners for many years and have come to the conclusion that besides the sericites and free silica there are also other factors at play that cause the disease of silicosis.

"My reason for making this statement is: Why should two men work under the same conditions underground, the one contract silicosis after two years and the other not after 14 years? This is very difficult to understand, unless there are also other factors along with sericite and free silica that produce silicosis. One man I examined worked for 29 years underground on the Reef, 27 years of which period he worked on machines (machine work is considered to be most productive of the disease silicosis). This man was old and by no means fit. I would have liked to have been able to recommend him for compensation. I had him x-rayed and re-x-rayed but could not prove that he even had the slightest beginning of silicosis. On the other hand I examined a man who spent two years underground, left the mines, was out of the mines for the following five years and at the end of that time had a definite silicosis. Such histories are by no means as rare as imagined.

"As I said, this is difficult to understand, unless there are some other factors combined with free silica or sericite which go to assist to establish the disease. Are these factors mechanical, physiological, pathological, or what? For these reasons the scientific bodies should combine and try to solve the question of 'prevention of silicosis.'"

Jones[7] responded that Irvine, Mavrogordato, Orenstein, Simpson, and Strachan agreed that the great bulk of the dust found in the silicotic lungs of Rand miners consists of minute acicular fibers and asked:

"What are these thousands of mineral fibers that are so conspicuous in the sections of silicotic lungs and in the residues obtained from them, when these are examined under the petrological microscope? . . . . Petrological examination of the fibers in the silicotic lungs of Rand gold miners shows clearly that they are sericite."

With regard to Mitchell's reference to the literature, Jones[7] suggested that references to minerals by medical authorities should always be checked by the examination of such minerals under the petrological microscope, as otherwise mistakes would be perpetuated.

In the discussion of a similar paper presented by Jones before the Institution of Mining and Metallurgy in London in January, 1934, Haldane[20] dissented most emphatically from the conclusions drawn by Jones. Haldane pointed out that what seemed to him to constitute perfectly clear evidence incriminating uncombined silica was not the nature of the dust

found in the lungs at death, but the history of prolonged exposure to dust containing a high proportion of uncombined or free silica. He found nothing to indicate that either the presence or absence of sericite had anything especially to do with the silicosis produced by quartz, while the evidence incriminating dust with a high percentage of quartz was overwhelming. Although he had once attributed the harmlessness of diluted free silica to a special quality of the diluent dust, Haldane said he had been converted by the experiments of Gye and Kettle—which indicated that the dissolved silica had positive detrimental effects—to the opinion that it was the action of the silica and not the absence of positive action of other dust that was important. He explained the presence of sericite in the silicotic lung as due to the fact that free silica dissolved gradually in an alkaline liquid, while natural silicates were much less soluble. The very small particles of free silica would therefore disappear more quickly in the living lungs, leaving silicates and only relatively large particles of free silica, as Jones had found. The free silica if in sufficient concentration and in a fine enough state of division in the phagocytic cells went into solution in their slightly alkaline medium and in so doing paralyzed their activity in both removing dust and handling tubercle bacilli, but if sufficiently diluted with other dust of any kind it would do no harm. At death nearly all the finely divided silica would have dissolved, leaving a residue of natural silicates and only relatively large particles of free silica. Haldane claimed that the smaller particles which had disappeared had done the real damage, not the large particles. Kettle[20] admitted that sericite might be responsible for a great deal of industrial silicosis, but he was not very much impressed with Jones' negative evidence that silicosis was not contracted where sericite was not present. It seemed to him to be going much too far to suggest that silica itself was incapable of producing the disease; conditions in the mines or in the various factories might interfere with the entrance of dust into the lungs, and the anomalous distribution of silicosis might depend on some such factor. He said the question of the solubility of silica was of great importance; there could be no doubt that a too readily soluble silica was just as incapable of producing lesions of silicosis as an absolutely insoluble silica. It had been shown that these lesions could be produced by the intravenous inoculation of crystalline silica; also in his laboratory the intravenous inoculation of amorphous silica had proved incapable of producing these lesions; such evidence indicated the complexity of the whole process. In conclusion, he stated that in his opinion Jones had presented a very strong case in support of his view that sericite was responsible for a great deal of industrial pneumoconiosis.

According to **Industrial Medicine**[16], a number of opportunities to examine samples of dust for sericite fibers have been presented in the United States. When examined petrographically samples of material collected where a great deal of drilling was being done through siliceous rock did not show an appreciable amount of sericite material, although it was definitely known that silicosis occurred by exposure to this type of dust. A recent report issued by the Commonwealth of Massachusetts relative to the findings of the Special Industrial Disease Commission also mentioned the examination of samples of different types of granite and foundry dusts. In certain petrographic examinations sericite was not found, in others it was found in very small quantities, and in additional samples the amount was appreciable. Although no general conclusion was reached the petrographers believed that in industry sericite could be avoided more easily than quartz.

The October 12, 1934, issue of the **Colliery Guardian**[17] quotes Irvine to the effect that "the apparent negative instances from the Mysore (Indian) gold field and the Lonely mine in Rhodesia are neither of them convincing, because neither so far has been adequately investigated." At one time it was said that there was no disabling silicosis in Cripple Creek in the United States; however, according to Russell[18], silicosis undoubtedly occurred there, but the miners who developed the disease left as soon as the altitude began to trouble them, and their deaths were recorded elsewhere.

Early in 1934 the Mysore government appointed a special committee, consisting of the chief medical officer of the Mining Board Kolar Gold Fields, the local medical officer of the Mysore government, and the physician of the Krishnarajendra Hospital, Mysore, to investigate the prevalence of silicosis among the miners on the Kolar gold-field area[19]. The committee conducted a preliminary investigation and unanimously concluded that silicosis does occur among the underground workers but that the incidence of the disease in the field is much smaller and a much longer time is required to develop signs and symptoms than in South Africa. This difference evidently is due to the fact that Kolar rock contains only 5 to 20% of free silica, whereas the South African samples contain 43 to 98%. Under the circumstances Irvine, of South Africa[19], has felt it necessary to contradict the statement that "in the Kolar gold field, India, where the rock contains a large amount of quartz and sericite is absent, silicosis has hitherto inexplicably been unknown."

Properties of sericite: According to Jones[7], sericite, sometimes called "secondary white mica," is a hydrous silicate of aluminum and potassium

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Accidents

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Anthracosis
Asbestosis
Baker's Itch
Benzol Poisoning
Carbon Monoxide Poisoning
Carbon Tetrachloride Poisoning
Chromium Poisoning
Lead Poisoning
Manganese Poisoning
Mercury Poisoning
Methyl Bromide Poisoning
Silicosis
Sulphur Dioxide Poisoning

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Glossary of Terms
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Compressed Air Disease
Fractures: Types and terms
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Hodgkin's Disease
Hydrocele
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6.06% water above 110° C., and
0.30% water below 110° C.

He said that sericite is most common in rocks that contain a high percentage of free silica in the form of quartz but is not present in all rocks that contain quartz; that the dust from rocks that contain abundant sericite as aggregates of acicular fibers has been proved to cause silicosis; and that the dust from rocks that contain no sericite or only occasional crystals of it but which contain a very high percentage of quartz—as high or higher than the rocks that had proved dangerous—apparently has not caused a single authenticated case of silicosis.

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Books

Commoner Diseases of the Skin, by S. William Becker, M. S., M. D., Associate Professor of Dermatology, School of Medicine, University of Chicago. 283 pp. 12 mo. Cloth. Indexed. National Medical Book Company, Inc., New York. $4.00.

DR. BECKER, as an authority on matters dermatological, needs no introduction; and he contributes from his knowledge and experience at the time when the subect of his special interest has ranking importance in industrial medicine. "Dermatitis as an occupational disease is becoming a greater problem each year." For example, of 692 claims heard on the Occupational Disease Calendar during 1933 in New York City, 461, or 67%, were for occupational skin diseases. And, in general, "more certificates of disablement have been issued for conditions of the skin than for any other compensable condition." His work is thus both timely and important. And, with a nice sense of these values and their practical application in current medicine, he treats of only the more common dermatoses. His handling of each is methodical, precise and complete.

The scope of the book is indicated by the chapter headings:

The Care of the Skin and Scalp;
Toxic Dermatoses of Epidermal Origin;
Toxic Eruptions of Dermal Origin;
Drug Eruptions;
The Neurodermatoses;
The Pruritides;
Neurodermatitis and Dyshidrosis;
Papulo-Squamous Eruptions;
Physical Dermatoses;
Vascular Diseases;
Cutaneous Infection, Pyogenic;
Tuberculosis of the Skin;
Cutaneous Infections, Fungus and Yeast;
Infections, Filtrable Virus;
Diseases Due to Insects;
Pigmentary Disturbances;
Diseases of the Sweat Glands;
Diseases of the Sebaceous Glands;
Diseases of the Hair and Scalp;
Diseases of the Nails;
Diseases of the Mucous Membranes;
Precancerous Dermatoses;
Cutaneous Neoplasms;
The Skin in Industry;
Allergy in Dermatology;
Formulary.

The chapter on the Neurodermatoses is particularly interesting; in it Dr. Becker disregards the dermatoses for the moment and studies the patient, finds that certain skin diseases occur solely in a certain type of patient, and, from intensive experience with such patients during the past several years, adopts the theory relative to the so-called functional diseases which he explains. His preface gives a hint: "Many heretofore mysterious dermatoses have been found to be always associated with nervous hyperactivity and exhaustion;" and throughout the book the theory finds proof in demonstrated results.

In addition to the very obvious value of this book to physicians gen-

erally—it has only to be seen to be appreciated—Dr. Becker's work has a special value to those in industrial medicine in that it will inspire the serious-minded industrial man to some heavy and profitable thought. The logic is this: Dermatoses may be the results of occupational hazards, or they may be the results of occupational maladjustments. In the one the causes are objective; removal of the hazard, treatment of the disease and payment of compensation will close the case. In the other, however, the causes are subjective, and a deeper therapy must be invoked. Treatment and compensation are only palliative; the cure will be the removal of the employee. And that is the point at which the work of the industrial physician begins to assume the transcendence that makes it a special calling, because removal in such a case means readjustment, and goes to the core of the economic value of medical service in industry.

Although there is something almost Freudian in Dr. Becker's theory, his attitude is that of the real scientist; his theory is a conclusion from experience, not an hypothesis for investigation. But the main purpose of his book is not the expounding of any theory. It is the study and explanation of the commoner skin diseases, with attention to underlying principles rather than to dogmatic presentation of data; and Dr. Becker accomplishes his purpose with such discrimination as to subject matter and such excellence in presentation as make his book almost necessary to the general practitioner and practically indispensable to the industrial physician.

Commoner Diseases of the Skin is one of the National Medical Monographys, edited by Dr. Morris Fishbein.

Industrial Maladies, by Sir Thomas Legge, Late H. M. Senior Medical Inspector of Factories and Medical Advisor to the Trades Union Congress. New York; Oxford University Press, 1934. 234 pp. $4.25.

DR. EMERY R. HAYHURST says of this book[1]: "In a methodical manner, the present work takes up the notification (reporting) of industrial disease and poisoning, followed by a chapter on compensation. Then follow in order, chapters on industrial diseases caused by bacilli; poisoning by lead, phosphorus and mercury, arsenic, other metals or their compounds, benzene and its compounds, other organic compounds and other fumes and gases. Industrial dermatoses and eczema, cancer due to pitch, tar, paraffin and mineral oil, pulmonary disease due to dust, and other industrial diseases—particularly the neuroses, the special senses, and compressed-air illness, complete the specific and technical discussion . . . . The reviewer has critically examined many sections of the work and is duly impressed with the vast amount of knowledge and practical experience contained, as well as with the feeling that he is reading a master . . . . The terminology, while medical, is easily within the grasp of the intelligent lay reader and should place the work upon the shelves of industrial, official, and educational libraries, as well as with individuals in several professions where industrial maladies are involved."

An English reviewer[2] says of this book: "It is for the medical man to pay adequate tribute to this book as a standard publication on the diseases introduced into, or exaggerated in every-day life, by industrial developments, but there is much material in it for the lay reader, who can have the unusual experience of enjoying parts of it whilst being able only to sense something of the invaluable contribution made by Sir Thomas Legge to a subject growing daily more and more vital to the community.

"In other words, it is the doctor who should possess and read 'Industrial Maladies,' not just the doctor definitely attached to a factory for definite duties, but the panel doctor, who touches industry indirectly every time he attends his crowded consulting rooms. At the same time, without possessing it, the book should be dipped into by anyone interested in or responsible for industrial health for in those portions comprehensible and pleasurable to the non-medical reader, lies much of the greatness of the work, romance, breadth of vision, and an underlying determination to prevent, not merely cure, or, worse still, fail to cure, the intolerable diseases in industry. In each of the chapters there is this background, so that we feel that it is not only a matter of diseases being under discussion so much as people.

"In an early chapter on compensation for industrial diseases, reference is made to the flint knappers in the palaeolithic and neolithic epochs, who must have been some of the first victims of industrial disease, as well as, later, the grinders of armour and implements of war, and the pot-

1. In *A.J.P.H.*, April, 1935.

2. *F.E.H.*, in *Labour Management*, July, 1935.

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tery makers in the middle ages, who 'yielded their quota,' along with the masons whose lives were sacrificed in the building of big cities.

"In the chapter on industrial diseases caused by bacilli, when discussing the preventive aspect of anthrax, the reader is taken rather suddenly and vividly across the world to the far east, to a realization of the immensity of area from which suspected material comes, whilst the fact that tetanus cases have occured in the past, in Dundee jute mills, gives some idea of the danger that threatens the workers daily in the humid plantations of Bengal.

"Industrial lead poisoning 'can only be prevented, it cannot be cured,' is the summing up of the chapter on this disease, and the stress laid on the preventive value of blood tests for lead absorption, which though expensive are so well worth the cost, points out the only possible action to be taken in any industry which exposes its employees to the hazard of lead poisoning.

"Phosphorus poisoning, we are told in another chapter, 'is mainly a subject of historic interest,' since the International Convention at Berne in 1906 prohibited the use of white lead in the manufacture of matches, but mercury poisoning, of which the symptoms are particularly unpleasant, is still very much with us. Evidence of ill-health from mercury, apparently, dates back farther than that of any industrial poisoning, being referred to at the end of the 17th century by writers who cite cases from classical times of its effects.

"Dr. Legge does not minimize the unpleasantness of the industrial diseases of which he writes, and justly so, for it is a high cost in world happiness to produce goods that in their production do such horrible things to the human body. Industrial arsenical poisoning, for example, makes one wonder how we can allow anyone to be subjected to the risk of contracting it.

"Industrial dermatitis, and eczema cases apparently are not sufficiently notified, and should be, as fuller investigation and preventive measures would prevent what is happening now in neglected cases, secondary complications of a most intractable kind.

"Two particularly interesting chapters, if any can be singled out from such an interesting whole, are those on pitch, tar, paraffin, and mineral oil cancer, and industrial pulmonary diseases due to dust. In the former emphasis is laid on the necessity for cleanliness as a potent means of preventing a disease that seems as baffling in its origins as when it was noticed in industry over a hundred years ago as 'chimney-sweep's cancer.' The chapter on dust is very definite in the statement that all dusts in excessive amount must be injurious, if not to the lungs, then to the upper air passages. Special reference is made to some of the early processes of flax, jute, and cotton manufacture, as the cause of asthmatic and bronchitic chest affections, with the strong recommendation that greater care must be observed in the removal of dust in precarding processes in the cotton industry."

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